

Video Methods Analysis App

T. Armstrong

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This app enables you to:

1. [Find, load, and play three views of video files stored on your computer.](#)
2. [Step forward and backward through a video.](#)
3. [Record comments synchronized with video time.](#)
4. [Save or load data as a .csv file](#)
5. [Upload a CSV file for continued analysis of the video.](#)
6. [Print or download comments and times as CSV](#)
7. [Capture and display a frame from the video.](#)
8. [Record X and Y coordinates of arbitrary points in the captured frame](#)
9. Hide sensitive areas of the captured frame
10. [Force pattern analysis and fatigue limits](#)



<http://www-personal.umich.edu/~tja/vidApp3/videoAnalysis.html>

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1. Loading the video:

- a. Clicking on the “Find & Load Video File” button (upper left) button opens a finder window for finding and selecting the video you want to analyze.
- b. The window below the “Find & Load Video File” button displays three views of the video.
 - i. By default, these views are offset by 0.1s to help you track the video's movements.
 - ii. The offset time can be changed by entering a new offset time value into the text box and pressing the “Apply offset” button in the frame below the video display frame.
- c. The app provides a link to a sample video that can be downloaded to gain familiarity with the app (see link in upper right corner).

2. Video controls

- a. The video controls are located immediately below the video. The controls include:
 - i. A “Play/stop” button
 - ii. A row of buttons -10.0s, -1.0s, -0.1s, -0.01s, +0.01s, +0.10s, +1.0s, and +10.0s enable you to advance the video forward or backward in the specified time increments.
 - iii. You also can specify a custom step size for moving forward and backward.
- b. The times the video was stopped are displayed below the center window (only when the video is advanced using forward and backward step buttons under the video window).

3. Add information about the video that corresponds to the center video window

- a. The App provides 6 fields for job/task annotations -- three for each hand.
 - i. The first field is intended for describing the actions of the hand. Most hand actions can be characterized as a reach or a move to a part, tool, or control, as grasp to gain control, as move to change the location or orientation of the object, or as position to adjust the final location or orientation of the object. Additional information may be provided to indicate the reach or move distance, the complexity of the grasp or move, or other information relevant to the analysis. Data entered into this field may be text or numbers. Commas should not be used in these fields. The

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data table can be saved in a comma-separated (.csv) format; extra commas will result in extra columns if the csv table is later imported back into the app or into a spreadsheet. Data can be separated using a "/" or other special character as needed.

- ii. The second field is for the force or moment exerted to complete the step described in the first field. Force must be a single numerical value for the subsequent analysis tools to work.
- iii. The third field is a "wild card" for additional comments or information that is deemed necessary by the analyst. These fields should not include commas for the aforementioned reasons.
- iv. The fields will be labeled "n, t (sec), RH Action, RH Force, LH Action, LH Force, Points" if the data are saved in a csv file for later analysis.
- v. It is advisable to save the data as a csv file periodically as a backup in the event of a system crash.
- vi. Note: The app was designed for collection of data necessary for application of the ACGIH Localized Fatigue and Hand Activity TLV®s. The fields can be used to collect information for other purposes. The field labelled "%MVC" assumes integer values between 0 and 100 and those labelled "Action" and "comment" assume text values. Other values may be entered and saved, but the process data feature (see below) will not function properly.

4. Save work:

- a. Reloading the webpage erases all data and breaks the connection with the video. Deliberate action is required to print or save data as CSV files (see below).
- b. You can return to the video time corresponding to a comment by clicking on that time in the table with your mouse or finger.
- c. The times and comments can be saved as a generic CSV file and uploaded to a spreadsheet, such as Excel or Google Sheets, for further analysis.
- d. The CSV file can be uploaded to this web app at a later time for continued analysis of your video.
- e. Note: csv files can be created independently using a spreadsheet program or text editor program as long as the data order in each row corresponds to order of the data in the data table. For this version video analysis app, the order is:

n,t (sec),RH Action,RH Force,RH,Comment,LH Action,LH Force,LH Comment,Points

n, t (sec), RH Force, ,LH Force must all be numerical values.

- f. The first row in the created csv file should be column labels.

5. Uploading CSV file

- a. CSV files with data from a previous analysis can be uploaded for further analysis

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- b. The CSV file must have the same format as the original stored file
 - i. Header row: n,t (sec),RH Action,RH Force,RH,Comment,LH Action,LH Force,LH Comment,Points
 - ii. All force values must be numerical for the plot routine to work. Use a zero for missing values.
 - iii. Use the “Load Data File” button at the time to open a search window for your file.
 - iv. The video file used to construct the data file must also be loaded if you plan to edit the data file.

6. Printing & copying data:

- a. The data table can be printed by clicking the “Data Table” button in the lower left corner.
- b. The data can be copied and saved by highlighting rows and columns of interest in the data table and using the appropriate copy-and-paste commands on your computer.

7. Extract individual video frames

- a. Extract individual frames from the video: click on the “Frame Capture Window” button. (see Fig 2)
- b. The video frame will be displayed in the “Frame Capture Window.”
- c. Save video frames: right-click on frame and select “Save Image As.”

8. Record the XY location of arbitrary points in a frame

- a. Record XY location of arbitrary points in selected frame: position cursor over point of interest and left click.
- b. Select as many points as desired. Points will be saved with annotations when you click the “Append Table” or “Overwrite” buttons.
- c. Save as many points as you like. The points will be stored as a string of x-y pairs, separated by semicolons. They can be parsed into separate columns in a spreadsheet or other app.

9. Hide sensitive areas of the captured frame

- a. Click on “Mask” checkbox under captured frame
- b. Use slider to adjust diameter of mask.
- c. Click on areas of frame to be hidden.
- d. Hidden areas will not show in downloaded copy of frame.

10. Force pattern parameters and fatigue limits (“Process Data” button Figure 3)

- a. Force pattern plots from beginning to end of the data table.
- b. Force parameters for applying fatigue and “Hand Activity Level” will be computed automatically.
 - i. The fatigue force threshold setting and exertion threshold setting are set to 10%, but can be changed to new values between 0-10%MVC; Percentile (for peak force calculation).
 1. Total Time: from beginning to end of plot.
 - ii. **ACGIH Fatigue TLV® parameters**
 1. Total Time Force > force threshold.
 2. **Duty Cycle:** $T_w / T_t \times 100\%$, $\%MVC_{work} = \sum \Delta t_i \times \%MVC_{worki} / \sum \Delta t_i$, where: $\%MVC_{wi} > \text{Fatigue force threshold setting}$.
 - iii. **ACGIH Hand Activity TLV® parameters**
 1. **Force Threshold Crossings** - count, frequency (exertion frequency).
 2. **Hand Activity Level** (0-100), **Peak Force** (0-100%), **Specified force %tile**.
- c. **Determine recommended Fatigue Limits**
 - i. Enter the desired Duty Cycle, DC, and $\%MVC_{work}$ into the corresponding text boxes and click on the “Apply TLV” button.
 1. The entered values will be plotted on the chart.
 2. maximum recommended average $\%MVC_{work}$ for entered DC shown at top.
 3. maximum recommended DC for entered average $\%MVC_{work}$ shown at top.
- d. **Determine recommended hand Hand Activity Limits**
 - i. Enter the desired HAL and peak $\%MVC_{work}$ into the corresponding text boxes and click on the “Apply TLV” button.
 1. The entered values will be plotted on the chart .
 2. maximum recommended peak¹ $\%MVC_{work}$ for entered DC shown at top.
 3. maximum recommended HAL for entered peak¹ $\%MVC_{work}$ shown at top.

References:

1. ACGIH® 2024. *Upper Limb Localized Fatigue* [2024 Guide to Occupational Exposure Values](#), Cincinnati, OH: ACGIH, pp 206-208
2. ACGIH® 2022: [Upper Limb Localized Fatigue: TLV® Physical Agents 8th Edition Documentation](#), Cincinnati, OH: ACGIH
3. ACGIH® 2024. *Hand Activity Level* [2024 Guide to Occupational Exposure Values](#), Cincinnati, OH: ACGIH, pp

¹ Use specified percentile for peak force

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4. ACGIH® 2022: Hand Activity Level: [TLV® Physical Agents 8th Edition Documentation](#), Cincinnati, OH: ACGIH

Video Work Methods Analysis App
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Find & Load Video File

Offsetss between videoplayers: 1.0 Apply

Load Data File (previous analysis)

File: attachClips153538.csv

Instructions(right click & "save link as")

Sample video(right click & "save link as")

SampleAnalysis(right click & "save link as")

VideoName: attachClips.mov;
Video Length (s): 18.115

0s

0s

1s

Play

-10s

-1.0s

-0.1s

-0.01s

+

+0.01s

+0.1s

+1.0s

+10s

Custom steps: 0.1

Back

Forward

Enter task attributes (do no use commas):

Action

%MVC

Comment

Rt Hnd:

Action

0

Comment

Lft Hnd:

Action

0

Comment

Open Frame Capture Window

Append Table

Sort Table on Time

Overwrite Row:

Delete Row:

Selected Row: None

n	t (sec)	RH Action	RH Force	RH Comment	LH Action	LH Force	LH Comment	Points
1	0	start	0		start	0		2,4,478,1,478,310,3,309
2	2.1	open clip/move/position	10	peak force mid-move	move/position cards	10		278,262
3	2.9	open/move/position clip	50	clip position precisely at corner of care	move/position cards	10		259,266
4	4	aside clip/cards to bin3	15	right hand asides clips/cards to approx location	idle	0	Assume LH waits for RH to catchup	187,9
5	5	Reach for clip bin1	0		reach for cards bin2	0	LH gets cards and RH gets clip	335,154
6	6	grasp/move/position clip	10		grasp/move/position cards	10		
7	7.1	open/move/position clip	50		move/position cards	10		
8	8.3	aside clip/cards to bin3	15		idle	0		

Print Data Table

Save Data To CSV File

attachClips

Process Data

Close Process Data Window

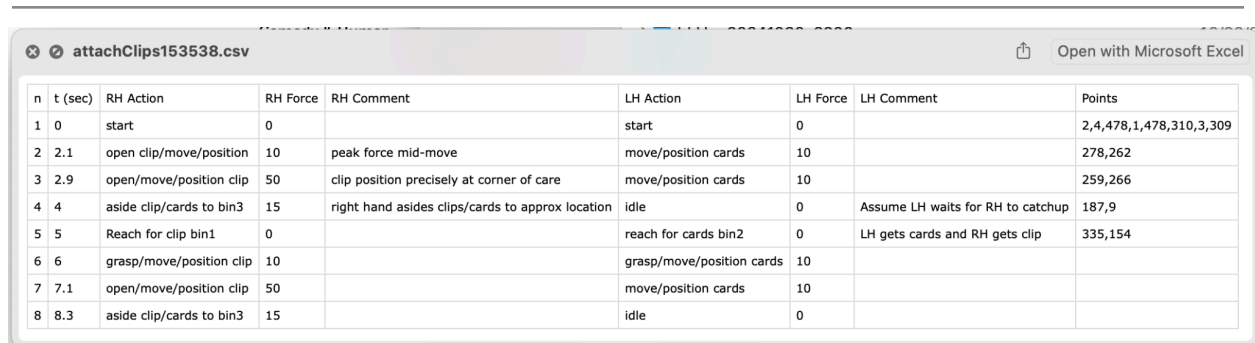
Fig 1: The desktop website for the video analysis app shows 3 views from a video file, "attachClips.mov," 18.115 seconds long. The video displays and displaced 1.0s. Observation data have been entered and recorded at 0, 1.5, 2.0, 3.8, and 4.4 seconds -- 1 cycle of this task.

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n	t (sec)	RH Action	RH Force	RH Comment	LH Action	LH Force	LH Comment	Points
1	0	start	0		start	0		2,4,478,1,478,310,3,309
2	2.1	open clip/move/position	10	peak force mid-move	move/position cards	10		278,262
3	2.9	open/move/position clip	50	clip position precisely at corner of care	move/position cards	10		259,266
4	4	aside clip/cards to bin3	15	right hand asides clips/cards to approx location	idle	0	Assume LH waits for RH to catchup	187,9
5	5	Reach for clip bin1	0		reach for cards bin2	0	LH gets cards and RH gets clip	335,154
6	6	grasp/move/position clip	10		grasp/move/position cards	10		
7	7.1	open/move/position clip	50		move/position cards	10		
8	8.3	aside clip/cards to bin3	15		idle	0		

Fig 2: Sample CSV file export.

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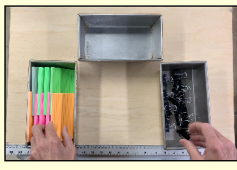
VideoName: attachClips.mov;
Video Length (s): 18.115



0s



0s



1s

Play
← -10s
-1.0s
-0.1s
-0.01s
—
+0.01s
+0.1s
+1.0s
+10s →
Custom steps:
Back
Forward

Frame Capture

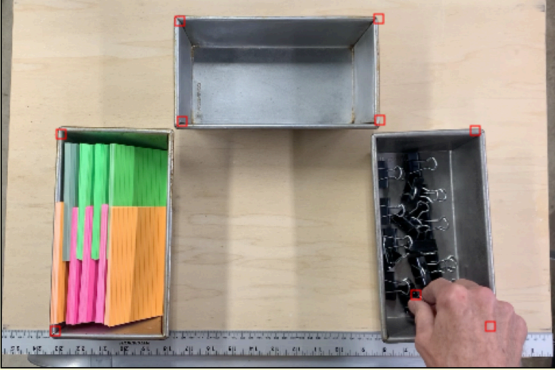
Get x-y coordinates for selected points

1. Position mouse over desired target
2. Click to get the coordinates
3. Repeat for all desired coordinates
4. Click "Append Table" or Overwrite Selected Row" to save

Hide selected parts of frame

1. Check "Mask"
2. Position mouse over desired to hide
3. Click to blot selected area
4. Repeat as desired
5. Blotted areas will not show in saved image

Selected points:
46,285,51,116,155,105,153,19,324,17,325,104,407,113,420,281,356,254



☐ Mask
Download frame

Enter task attributes (do no use commas):

Right Hand

grasp/move/position clip

Left Hand

grasp/move/position cards

Close Frame Capture Window

Append Table
Sort Table on Time

Overwrite Row:
Delete Row:
Selected Row: 1

n	t (sec)	RH Action	RH Force	LH Action	LH Force	Points
1	0	grasp/move/position clip	5	grasp/move/position cards	5	4,312,8,1,475,4,476,311,347,253
2	1.5	open clip/move/position	50	move/position cards	5	
3	2.9	aside clip/cards to bin2	5	reach to bin 1	0	
4	3.8	reach for clip bin 3	0	idle	0	
5	4.4	grasp/move/position clip	5	grasp/move/position cards	5	

Fig 2: "Frame Capture Window" open. The cursor's location is recorded in the left window each time the left mouse button is clicked. Points are recorded as a string by clicking the "Append Table" or "Overwrite" buttons with the actions and forces of the right and left hands. Sensitive areas of the image can be hidden by checking the "Mask" box and clicking on the areas to be hidden. The image can be saved by right-clicking on the image and selecting "download" from the drop-down menu.

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#	t (sec)	RH Action	RH Force	RH Comment	LH Action	LH Force	LH Comment	Points
1	0	start	0		start	0		
2	2.1	open clip/move/position	10	G3M3P0	move/position cards	10	G3M3P0	
3	2.9	open/move/position clip	50	M2X4P2	move/position cards	10	M2P2	
4	4	aside clip/cards to bin3	15	M4P2	idle	0	M6P0	
5	5	Reach for clip bin1	0	M4GOM2	reach for cards bin2	0	M4	
6	6	grasp/move/position clip	10	G3M3P0	grasp/move/position cards	10	G3M3P0	
7	7.1	open/move/position clip	50	M2X4P2	move/position cards	10	M2P2	
8	8.3	aside clip/cards to bin3	15	M4P2	idle	0	M6P0	

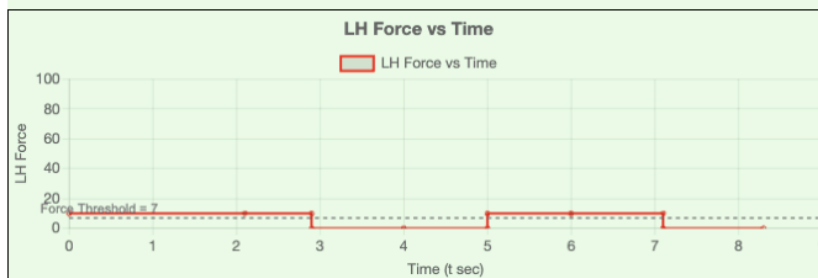
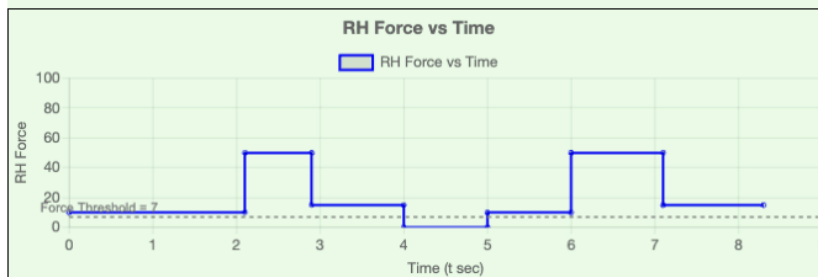
Print Data Table

Save Data To CSV File

Enter filename

Process Data

%MVC v. time



Force profile statistics (based on start and end times shown in force data table and plot)

Fatigue force threshold setting (0-10%MVC): ; Percentile (for peak force calculation):

Total Time: 8.30 sec

ACGIH Fatigue TLV® statistics

RH Total Time Force > force threshold: 7.30 sec

LH Total Time Force > force threshold: 5.00 sec

RH Duty Cycle: 88%, %MVC_{work}: 22%

LH Duty Cycle: 60%, %MVC_{work}: 10%

ACGIH Hand Activity TLV® statistics

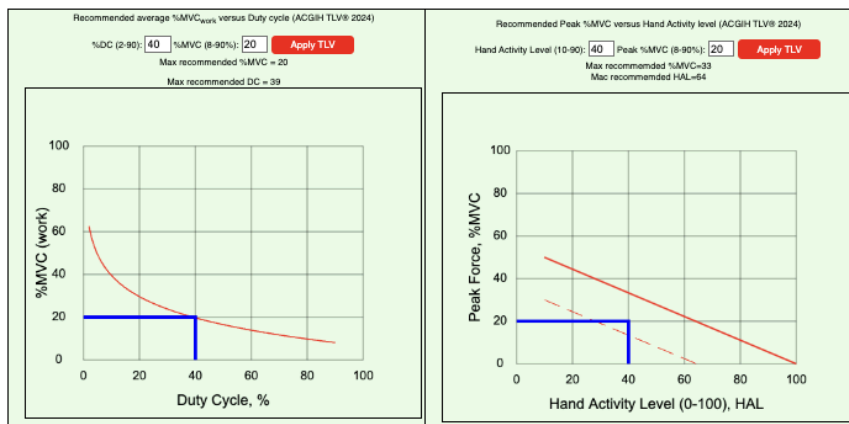
RH Force Threshold Crossings - count: 2, frequency: 0.24/sec;

LH Force Threshold Crossings - count: 2, frequency: 0.24/sec;

Right: Hand Activity Level (0-100): 26, Peak Force: 50%, Specified %tile Force 50.00%

Left: Hand Activity Level(0-100): 16, Peak Force: 10%, Specified %tile Force 10.00%

Recommended limits



Close Process Data Window

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Fig 3: The open “Process data” window showing a plot for 1 cycle of data extracted from the “attachClips1.mov” file. Force pattern parameters include total time, work time (greater than fatigue threshold), duty cycle, and %MVC_{work} (time-weighted force average force > fatigue threshold). The TLV® plot shows the recommended %MVCwork limit for a given duty cycle or visa versa.