Chapter 5

Analyzing Performance

DARTFISH

Version 4.0

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1 Analyzing Performance

Dartfish's Analyzer module offers a complete set of features to help observation and understanding of performances. This chapter guides you through these allowing you to:

Compare video

Up to 4 clips can be compared side by side and 2 clips can be blended. It is quick to synchronize clips to make the action contained comparable. You are not limited to just four clips in your analysis as a project can contain multiple analyses in its *Storyboard*.

Annotate video

A collection of drawing and text tools help enhance observation, make measurements of distance, angles and time and add text to video clips. Tools exist to enhance the effectiveness of drawings such as automatic tracking and fading them in and out at relevant positions in the vide clip.

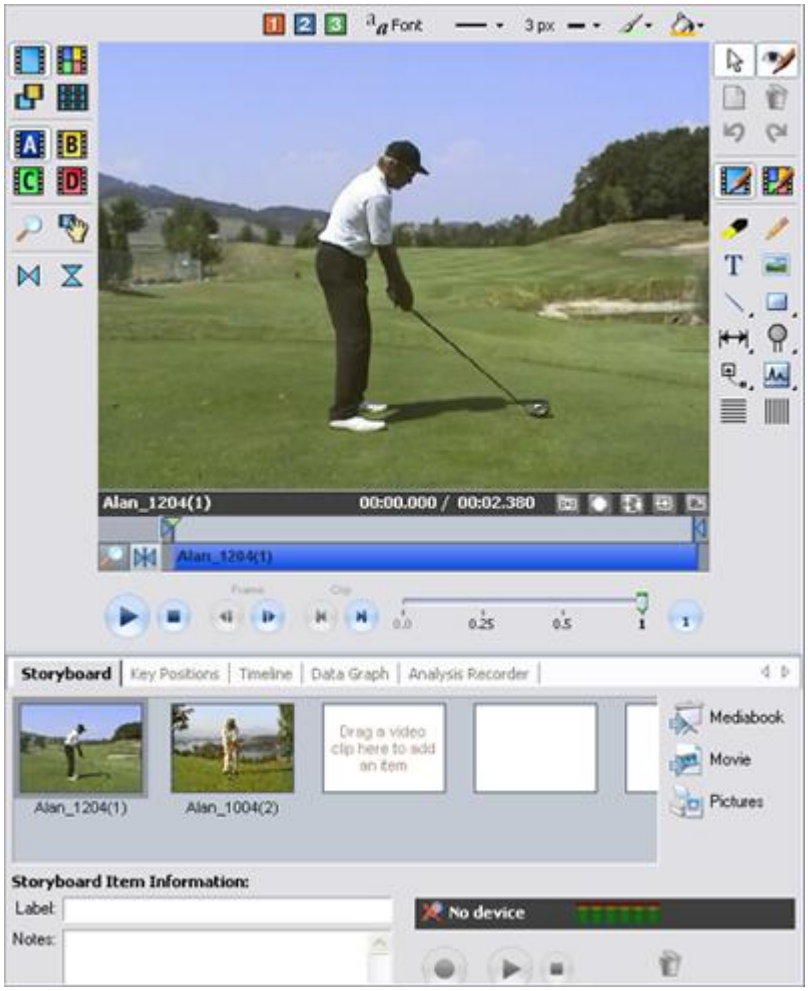
Text or audio comments can be added to an analysis to create a lasting record of your analysis and to save time, previous comments can be imported from existing analyses.

Identify important moments

Key Positions can be identified and drawings and comments added to them. Each key position can also be used to synchronized multiple clips.

1.1 Analyzer workspace

The *Analyzer* workspace is illustrated below:



Its main constituents are:

- *Video Screen* - to display the clip(s).
- *Timeline* - (underneath the video screen), to control the playhead position and set the *cue in/out* points to define the playable part of the video (play range).
- *Play controls* - (underneath the timeline) to control the video playback.
- *Display mode* - (top-left) to change the screen display. You can select among *Single-screen, Split-screen*, *Blend* and *Mosaic* modes. The *A, B, C* and *D* buttons show/hide a clip. In split-screen modes, they are used to select between up to four clips to display simultaneously.
- *Image Enhancement tools* - (underneath the C, D buttons) to zoom in/out or flip the images.
- *Drawing tools* - (on the right) to draw on the video.
- *Storyboard* - (underneath the play controls) contains the different analysis of an *Analyzer* project.
- *Publishing* - (on the right of the storyboard) to publish your analysis on different media (CD, e-mail, printer, Internet) or to create a movie of the *Storyboard*.
- *Notes* - (at the bottom) to add written and audio comments. To see this area it may be

necessary to resize the Analyzer views area. This is done by click and dragging its top border using the mouse shape shown in the following illustration.

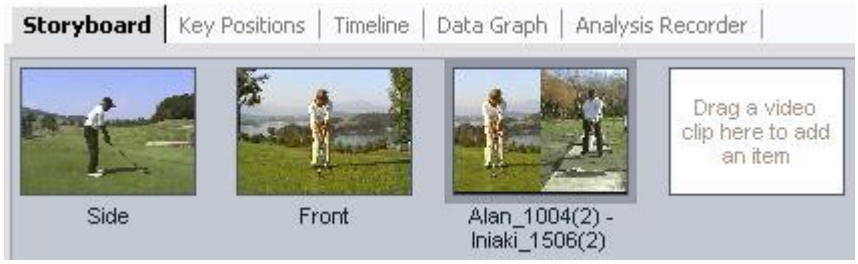
! You can switch between different views using the following tabs

The *Data Graph* is used to display external data streams (such as the heartrate, speeds, etc.) captured by external devices such as radar, heartrate monitors, force platforms etc. Such streams are synchronized with the video. More information can be downloaded on http://www.dartfish.com/downloads.

Read the remainder of this chapter to learn about *Analyzer* functions and about the other views.

1.2 An analyzer project - the Storyboard

The *Storyboard* can contain multiple analyses that constitute an *Analyzer Project*. Each item in the Storyboard corresponds to one analysis. For example, you could analyse swings of a students captured during a training session, one from the front, one from the side and one from the front compared to a reference swing, as illustrated below.



Each analysis may include drawings and audio commentary. All this is saved in your *Analyzer Project* along with the videos.

Your project can be:

1. Re-opened later to modify/add analysis elements (e.g. add a fourth swing, modify a drawing, etc.)
2. Published to different destinations (e-mail, CD, printer, internet) to be handled out to your student/athlete (see Publishing Analysis).

1.2.1 Loading clips

Clips can be loaded as multiple clips within a single analysis or as a new analysis.

To load a clips into an analysis

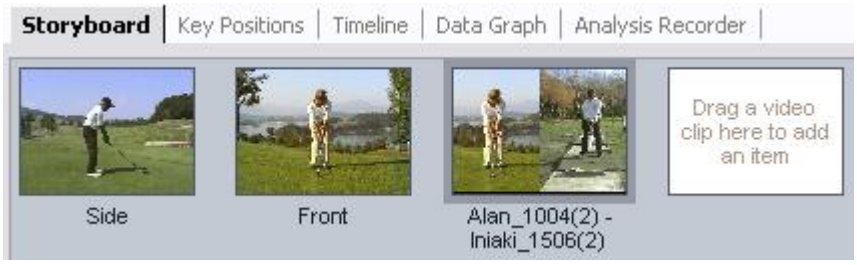
1. Activate a vacant video display screen A, B, C or D in *Single-screen mode* or display the required number video display screens in *Split-screen mode.*
2. Double click each clip in the *Items List* or the *Tray* of the *Library.*

You can also drag & drop a clip onto any video display screen. This offers greater flexibility over which video display is used. This method can also be used to replace a previously

loaded clip.

To add a new analysis (i.e. a new *Storyboard* item)

Drag & drop a video from the *Items List* or *Tray* onto a vacant position on the storyboard.



To replace a Storyboard item

You can replace the video clip of a *Storyboard* item with another one. To do this, drag & drop the new clip on top of the old one.

To delete an analysis (i.e. delete a *Storyboard* item)

Right-click on the *Storyboard* item and select *Delete* from the context menu.

! Starting a new project (*File>New* from the menu bar) will empty all items from the *Storyboard*.

1.2.2 Playing clips

Once a clip is loaded you have the ability to control the playback (play/pause, stop, frame-by-frame, etc.). This can be done by using the playback controls buttons and the timeline underneath the video screen.

Read the Video Playback section in the *Getting familiar* chapter to learn more.

! The functions of the buttons are the same as for the *Player* module except for *Play next/previous clip* and the *Repeat mode* which applies to items of the *Storyboard* rather than items of the *Tray*.

1.2.3 Saving an analyzer project

Select *File>Save* (or *File>Save As...*) from the *Menu bar* to save a project. *Analyzer* projects can be identified by the following icon.

 - Analyzer project

! If a project is saved in a *Monitored folder* of the *Library* (see section Defining your library in the Library chapter), it will be displayed in the *Items List*.

To open a saved project

- Double-click on the project in the *Items List*
- Select *File>Open* from the *Menu bar*

To start a new project

Select *File>New* from the *Menu Bar*.

! Starting a new project empties the *Storyboard*.

1.3 Analyze a performance

In this section, you will learn to use the different tools to analyse a performance:

- Image transformation tools - such as zoom and flip horizontal or vertical (see Enhancing images).
- Drawing tools - qualitative tools to highlight details and quantitative tools to extract statistics out of the video (see Drawing on the video).
- Comments - audio and written comments (see Adding comments).
- Key positions - break down a movement and analyse its key positions separately (see Analyzing key positions).

1.3.1 Enhancing images

Dartfish's *Analyzer* allows you to zoom in or out on an image to better see the details of a particular moment. There are many ways to zoom in/out:

1. Use the *Maximize video* button at the bottom of the *Analyzer* screen (3rd button in the illustration below). When selected, the video is enlarged to occupy the available height of the display area (to do this the left and right edges of the video may be hidden).

2. Use the *Display video fullscreen* button (right-most above). The video is displayed in full screen (press [ESC] on your keyboard to return to normal view).
3. Click on the *Zoom Tool* button, position the mouse cursor over the part of the picture that you want to zoom on and left click (right click to zoom out).

4. Click anywhere in the *Analyzer's* screen and use your mouse scroll-wheel. The image will zoom towards the location pointed by your mouse cursor.

Once the image has been zoomed in, you can move the zoom focus in two ways:

1. Click on the *Move Tool* button and drag the mouse cursor until the screen displays the part of the image you want the zoom to focus on.

2. Click and drag the mouse wheel button.

! You can play the clip(s) once it is zoomed. The zoom factor is maintained.

Zoom options

Clicking on the *Zoom Tool* button displays options at the top of the *Analyzer*'s screen:

From left to right, the buttons give access to the following function:

- *Reset Zoom* - resets the zoom factor to 100%
- *Zoom In* - each click increases the zoom factor by 20%
- *Zoom Out* - each click decreases the zoom factor by 20%
- *Zoom Factor* - set the zoom factor by selecting it from a predefined list
- *Quick Magnify* - changes the mouse cursor to a magnifier to quickly point to details.

  ! You can change the zoom factor inside the *Quick magnify* tool by using your wheel mouse. [shift] + wheel mouse will modify the radius of the magnifier.

Flip a Clip Horizontally or Vertically

To get a new perspective on a clip, you can flip it horizontally or vertically. To do this, click the *Flip Horizontal* or *Flip Vertical button*. The button appears as "pushed". You can flip the image horizontally and vertically at the same time.

1.3.2 Drawing on the video

The Analyzer allows you to draw shapes and add text on top of a clip's images. Use qualitative drawings (e.g. lines, circles, rectangles, etc.) to highlight details. Quantitative tools (angles, measurements, etc.) can be used to extract statistics from the video.

The Drawing Toolbar

Use the following toolbar to draw and write text on the video.

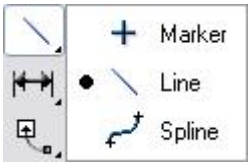
Drawing management tools - to select, show/hide, delete, and undo/redo drawings.

Video Drawing vs. Screen Drawing - two modes to draw on clips.

1. In the *Video Drawing* mode, your drawings are associated with the selected clip.
2. Use the *Screen Drawing* mode to draw across the *Analyzer*'s screen (see Comparing performances).

Drawing tools - the various tools to draw on the video. Most of these tools are self-explained. Read the remaining of this section to learn about the more advanced tools.

! The tiny arrow on the lower-right of a drawing tool indicates that other tools of the same type can be accessed by a mouse right-click, as illustrated below:



1.3.2.1 Adding and modifying drawings

To add a drawing

1. Display the frame of video to which you wish to add shapes and/or text. To do this, you can drag the playhead and use the frame-by-frame buttons.
2. Select a drawing tool
3. Position the mouse cursor on the image at the point where you want to start drawing
4. Left click, hold and move the mouse to the end point
5. Release the mouse button

! Although you are drawing on a single frame of video, the drawings will be displayed for the entire clip. Use the key position analysis (see Analyzing key positions) if you want to apply different drawings to different frames. It is also possible to fade drawings in and out so that they only appear for part of the clip (see Fading drawings in and out).

! Holding down the [shift] key "constrains" drawing, e.g. to draw a horizontal line, a square, a circle, a 90 degrees angle, etc...

By default, selecting a drawing tool once let you draw a single object. If you would like to draw the same object many times in a row (e.g. multiple lines), select the currently selected tool a second time. A vertical gray mark appears in the tool and indicates that you are in a

"repeat drawing" mode.

To leave this mode, click the selected tool a third time or select another one.

To modify a drawing

1. Click the *Selection* button (top-left of the drawing toolbar).
2. Click on the shape you want to select. White handles appear on the object.

To select multiple shapes, hold down the [Ctrl] key as you select additional shapes.

3. Once the object(s) is selected, you can:
   - Drag a handle to change the size or shape of the object.
   - Click and drag the selected object to another location.

To delete drawings

- Use the *Delete All* button

- Select a shape and press the [delete] key or use the *Delete* button

- Use the *Undo*/*Redo* buttons

1.3.2.2 Drawing properties

You can change the thickness, color, opacity, size and other properties of the drawings. The *drawing properties bar* is displayed at the top-right of the *Analyzer* video screen:

To modify a property:

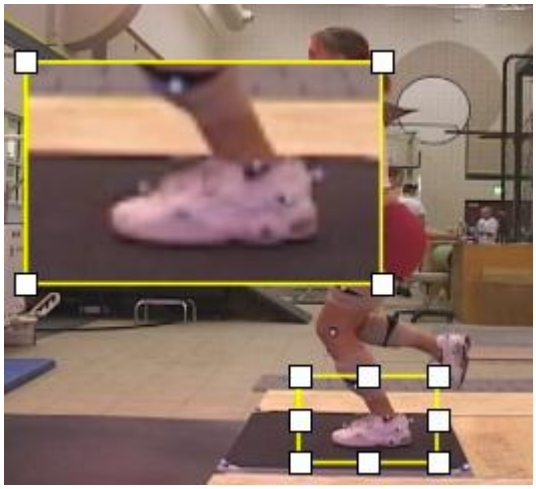
1. Click on the drawing to select it.
2. Click the button that corresponds to the property you want to modify.
3. Select the different value/color/font.

! The *1, 2* and *3* buttons correspond to properties *presets*. Left-click on these buttons to apply a preset. To change a preset:

1. Modify the properties
2. Right-click one of the *1, 2* or *3* buttons.

1.3.2.3 Clone rectangle

The *Clone rectangle* tool allows you to "clone" and magnify an area of the image. Play the video to visualize both the magnified area and the performance in its whole (picture-in-picture effect).



To use this tool, proceed as follows:

1. Select the *Clone Rectangle* drawing tool

2. Click, hold and move the mouse cursor to draw a rectangle around the area you want to clone.
3. Click and drag the cloned area to the location you want
4. Use the white handles to magnify the cloned area
5. Click anywhere in the image (except the drawing itself) to deselect the cloned area.

! For best result, use a tripod and leave the camera fixed (no zoom, pan or tilt). If the camera moves, you can still use this effect but in conjunction with the *automatic tracking* function (see Tracking objects automatically).

1.3.2.4 Picture

You can open a picture and overlay it on top of the video. You can use for example this function to insert your logo or to compare a key position to a reference image.

To add a picture

1. Select the *Image* tool. The *Open Image* dialog opens.

2. Browse for the image on your disk and click on the *Open* button. The image overlays on top of the video screen.

You can change the size of the picture by dragging the white handles. Hold down the [shift] key while doing this operation to constrain the proportion of the image. You can also click and drag the image to a different location.

If the image width is larger than 360 pixels, it will automatically be resized to this value.

Images can also be added by drag-and-drop from the Library onto the video screen.

Use the *Opacity* property to change the picture transparency.

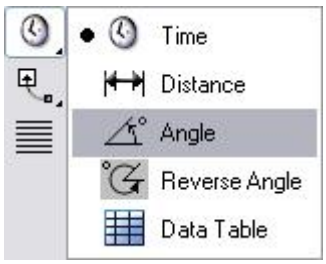
If you load an image in *Screen Drawing* mode (see Drawing on the video), it will always be overlayed at the same location in the video. Use this, for example, if you want your logo to be displayed always at the same location.

1.3.2.5 Measuring angles

The image below illustrates the *Angle* tool.

To add an angle:

1. Right-click on the *Time* button and select *Angle* from the context menu.



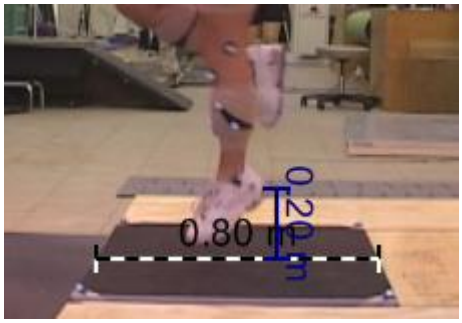
2. Position the mouse cursor on the image exactly where you want the corner of the angle to be.
3. Left-click, hold and move the mouse cursor (in the image above, click on the club head and move horizontally). A line draws as you move the mouse.
4. When the line extends to where you want the angle to open, release the mouse button.
5. Move the cursor up or down to create the desired angle. The number of degrees of the angle is shown as you move the mouse.
6. Click the mouse when the angle is the desired width.

! You can modify the line thickness, colors and font (see Drawings properties).

Hold down the [shift] key while drawing to constrain the angle to 0, 45, 90, ... degrees.

1.3.2.6 Measuring distances

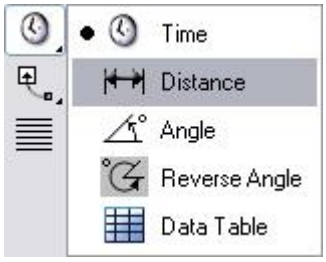
The image below illustrates the *Distance* tool.



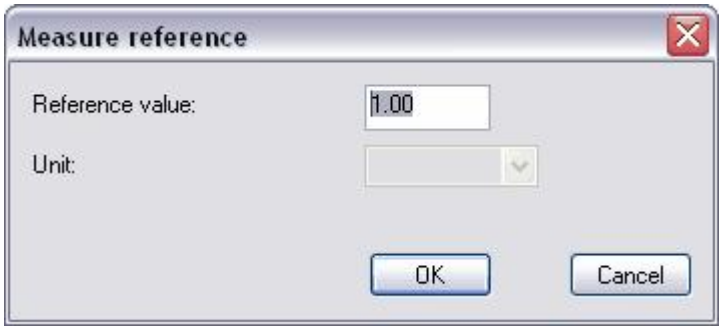
Distances are only precise in a plane perpendicular to the camera. You first have to calibrate this plane by defining a reference distance. To do this, put an object of known length at the position where the movement will be performed (the width of the mat in the above example).

To measure distances, proceed as follows:

1. Right-click on the *Time* button and select *Distance* from the context menu.



2. Click, hold and move the mouse cursor to draw the reference distance (the one with the dashed line in the image above)
3. Right-click on the reference distance and select *Set as reference...* from the context menu. The following dialog opens



4. Enter the size of the reference object.
5. Select the *Distance* tool again and draw the distance (vertical line in the example above). It will be computed based on the line length and the reference value.

The measurement precision relies on many factors such as the distance between the camera and the performer, the camera zooming factor, the precision of the perpendicularity between

the camera axes and the plane in which the movement is performed, etc... Try to be as precise as possible when setting the reference distance. For example, use a well defined and distinct marker on the floor and use zoom tools to enlarge the image when setting the reference distance.

1.3.2.7 Using stopwatches

Dartfish allows you to use multiple stopwatches

- to estimate the duration of a performance,
- to measure time in different sections of a performance/race,
- to estimate/compare different time/speeds.

The stopwatch displays the time in minutes:seconds.frames (mm:ss.fff). Its precision is function of the number of fields/sec, i.e 2'' of a second for PAL video (50 fields/sec) or 1.66'' of a second for NTSC (60 frames/sec).

To add a stopwatch

1. Select the *Time* tool

2. Click anywhere in the image to insert a stopwatch. Use the drawings properties (see Drawings properties) to modify the color and font.

The stopwatch displays the current position of the playhead at the moment it is inserted in the image.

To reset a stopwatch

1. Right-click on a stopwatch
2. Select *Set timecode to 00:00* in the context menu

To start/stop counting

You can start and stop counting in a section of a performance/race. For example, you may want to compute the time from gate 1 to gate 7 in a giant slalom to compare performances in this particular section. To do this:

1. Position the playhead at the position you want to start counting
2. *Set timecode to 00:00* (optional)
3. Right-click on a stopwatch and select *Start counting*
4. Position the playhead to the end of the section
5. Right-click on the stopwatch and select *Stop counting*

! You can change the start and stop position by setting them to a new position. To disable this

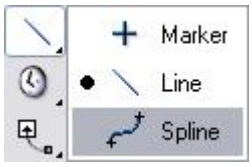
feature, simply uncheck the *Start* and *Stop counting* from the drawing context menu.

1.3.2.8 Tracking objects manually

You can draw trajectories by manually tracking object in the video clip. For example, you could draw the swing plane as illustrated below. The yellow curve represents the up-swing and the orange one, the down-swing. Dartfish creates the trajectory by joining selected points while smoothing the curve in between. The trajectory redraws as the video plays (see image on the right).

To draw a curve, use the *Spline* tool and proceed as follows:

1. Right-click on the *Line* button and select *Spline* from the context menu.



2. Position the playhead at the beginning of the performance.
3. Click on the object you want to track. A white square indicates the first point of the curve.
4. Use the [ctrl] + left/right arrow keys to move the playhead forward a few frames.
5. Repeat steps 2 and 3 as many times as needed.
6. Right-click and select *Finish* from the context menu to terminate the curve.

To modify the trajectory, select it and move any point you have defined. The curve modifies accordingly.

! The trajectory draws as illustrated above only if it is deselected (white squares not visible). To do this, click anywhere in the image but on the curve itself.

! The curve can be drawn on a single frame. In this case, no tracking takes place.

The number of points you have to define varies according to the speed of the object. The faster the object, the more points you have to add to get a smooth curve.

1.3.2.9 Tracking objects automatically

Dartfish offers you a powerful function: the *automatic tracking* (available in the *TeamPro* and *ProSuite* editions). The principle is the same as for the manual tracking (see previous section) except that the computer automatically tracks and optionally draws the trajectory of an object(s). The *automatic tracking* function can be used with most of the drawing tools:

- e.g. with the *rectangle, oval, clone rectangle* to highlight the evolution of an object/performer throughout the video.
- e.g. with the *marker* tool, to automatically draw the trajectory of a well defined feature.

- with the *spline* tool (see Tracking objects manually) to visualize the evolution of the shape of an object/body over time. In this case, each point of the curve is tracked separately.

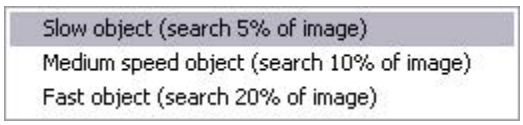
- with the *angle* (see Measuring angles) and *distance* (see Measuring distances) tools to measure the evolution of such data.

- with the *Data table* (see Using data tables) to automatically extract statistics from the image and store them in a spreadsheet.

Tracking is a complex process; for Dartfish to successfully track objects they must remain clear and visible. You can help it by tracking clear features with a high contrast. Try to use markers as illustrated in the pictures above.

To activate the automatic tracking

1. Position the playhead at the beginning of the performance
2. Draw a shape on the video
3. Right-click on the shape and select *Tracking* in the context menu
4. Select the object speed from the context submenu (this defines how far from the last position Dartfish will search the video image for similarly colored/shaped objects).



5. Click the image to deselect the object

Using the automatic tracking

To start tracking, simply play the video. The drawing color changes to green indicating that Dartfish has started to track the object. At any moment, you can pause playing:

- If you observe that the tracking is "lost" (e.g. when the object gets occluded). In this case, manually reposition the drawing onto the tracked object and continue playing.
- If the object disappears from the field of view. In this case, right-click on the drawing and select *Suspend tracking* from the context menu. Dartfish stops tracking from this position (the drawing color changes to red).

To show the trajectory

Once you have activated automatic tracking (see above), right-click on the drawing and select *Show trajectory* from the context menu. The trajectory progressively draws as the video plays.

1.3.2.10 Fading drawings in and out

In most cases, drawings are valid only for a small portion of a movement. You can use the *Fade in/out* function to display a drawing only during such a portion. To do this, proceed as follows:

1. Position the playhead at the desired position.
2. Draw an object on the video
3. Step a few frames backward (using the [ctrl] + left and right arrows)
4. Right-click on the object and select *Fade in* from the context menu.
5. Select how quickly the drawing appears from the context submenu.

6. Step a few frames forward.
7. Repeat the steps 4. and 5. to set the *Fade out.*
8. Deselect the drawing and play the video from the beginning. The drawing will only show in the defined portion.

! Use this function if you want to publish a new video that contains drawings that fade in/out. If you want to analyse key moments of a performance we recommend you use the *key positions* (see Analyzing key positions) which can be printed or published in an interactive Dartfish *Mediabook*.

1.3.2.11 Using data tables

The *Data Table* drawing tool enables you to collect time-dependent data related to the action in your video. For example, at different time instances you can manually enter the distance an athlete has run so far, just as you would in an Excel spreadsheet. Then, the data table tool can compute (and display) automatically the average overall speed or the interval speed of the athlete. It is also possible to link another drawing tool such as an angle or a measuring tool to a column of a data table, to display and store the evolution of the corresponding quantity (angle/length) over time. In the following image you can see a data table containing heights inferred by a measurement drawing.

An advanced feature is the option to track an object in the video automatically and to display the corresponding positional data in a data table. Finally, you can export the collected data in Excel format for further processing and analysis.

A comprehensive guide on how to use this drawing tool can be downloaded on the Dartfish website (visit http://www.dartfish.com/downloads).

1.3.3 Adding comments

The *Analyzer* allows you to "produce" enriched multimedia content. It gives you the ability to combine your coaching expertise with images to generate powerful presentations (see Publish Analysis) that you can share with your athletes/students for use with their daily practice. You already learned how to add drawings on the video to highlight details or to extract statistics from the images (see Drawing on the video). In this section you will learn how to add verbal and written comments which can be used to analyze:

1. a performance in its whole (*global* comment).
2. key positions (or key moments) of a performance (*key position specific* comment, see Analyzing key positions).

1.3.3.1 Written comments

To add written comments, simply enter your text in the *Notes* box, as illustrated below:

This box is located on the lower-left of the *Analyzer* module (in the *Storyboard* or *Key positions* tabs).

1.3.3.2 Audio commentary

To add an audio commentary:

1. Select the audio recording device from the drop-down list of the *Recording Device* pane. This pane is located on the lower-right of the *Analyzer* module (in the *Storyboard* or *Key positions* tabs).

Use the microphone of your camera to record audio (the camera has to be connected to the computer through the Firewire cable). Alternatively, you can use a microphone and select your sound card as the audio device.

2. If needed select the input. If you have plugged a microphone in your sound card, select "Microphone".
3. Click on the *Record* button to record your audio comment.

4. Click on *Stop* when you are finished.

Use the *Play* button to play back the recorded audio comment.

Recording a new audio comment overwrites the last recorded one.

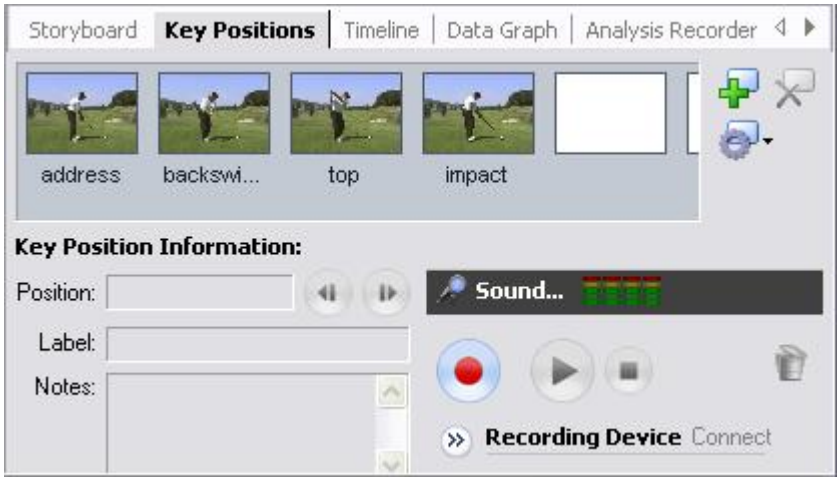
To be more fluent and comfortable recording an audio comment, you can first write your comment in the *Notes* box and read it simultaneously as you record audio.

1.3.4 Analyzing key positions

Key position analysis allows you to break down a movement and to analyze its important moments by using drawings, audio and written comments. Key positions allow you to display specific moments quickly. You'll also have the ability to publish the key positions in two formats:

1. The *Mediabook* - an interactive multimedia analysis that you can save to a CD-ROM, send via e-mail, or publish on the Internet (see Producing mediabooks).
2. A printed report - the collection of key position images printed in different layouts (see Creating still images).
3. Still pictures - JPEG of BMP files that can be stored on your disk or send via e-mail.

To use key positions analysis, select the corresponding tab in the lower part of the *Analyzer*.

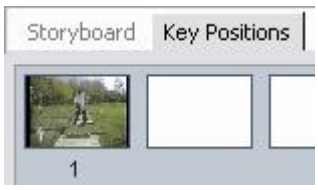


1.3.4.1 Adding key positions

To add a key position, proceed as follows:

1. Move the *Playhead* to the position you wish to highlight. Use the *Frame* buttons (or the [ctrl] left and right arrows) to refine the position.
2. Click on the *Add Key Position* button.

A new key position appears with its default label underneath.



To add other key positions, repeat the two steps above.

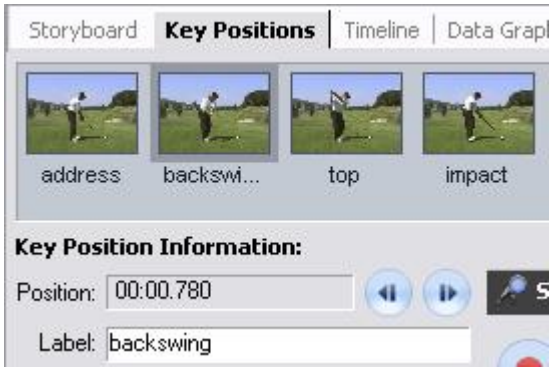
! Key positions can be added in any order. Say you analyze a long jump, you can first create the key position of the landing followed by the one when the jumper hits the board.

! The default labels are integers (1, 2, 3, etc.)

Try to make a consistent use of the labels. You will see in section Synchronizing video clips that clips can be easily synchronized by matching key positions with the same label. Read next section to learn how to edit the label.

1.3.4.2 Editing key positions

To edit one key position, select it by clicking the corresponding thumbnail...



... and do one of the following operations:

- rename the label - type the new label in the *Label* box (e.g. *back swing* in the illustration above)
- change the video position - use the left and right arrows next to the *Position* box.

- change the order - key position do not need to be listed in a chronological order. You can change the order by drag-and-drop.

  ! The key positions will be published in the same order as they appear in the list.
- delete - use the *Delete key position* button or right-click on a thumbnail and select *Delete* from the context menu

You can delete all key positions by clicking on the *Display Key Positions Options* button and selecting *Delete All Key Positions.*

1.3.4.3 Analyzing a key position

To analyze a key position:

1. Select the key position by clicking on the corresponding thumbnail (or create a new one, see Adding key positions). The selected key position is highlighted and the screen displays the corresponding video position (*top* in the illustration below).

2. Add your analysis by using:
   - drawings (see Drawing on the video)
   - written comments (see Written comments)
   - audio comments (see Audio commentary)

! Your analysis is automatically attached to the selected key position and saved with the clip.

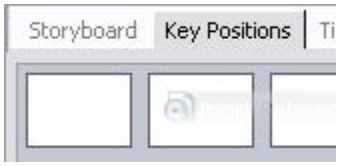
If you add a *global* drawing (when the *Storyboard* view is selected), all new key positions will "inherit" this drawing. This can be used if you want a drawing to be positioned exactly at the same place in all key positions. You still can delete the drawing in a particular key position if not needed.

1.3.4.4 Importing key positions

You can import an analysis that was performed on a clip and use it as a basis for a new one. Your library can thus contain a set of "reference" clips that you already have analysed. Select the one that could best be used to automatically create the key positions and import the existing annotations. Once imported, you'll only have to slightly adapt the video position of the key positions and edit the drawings/text.

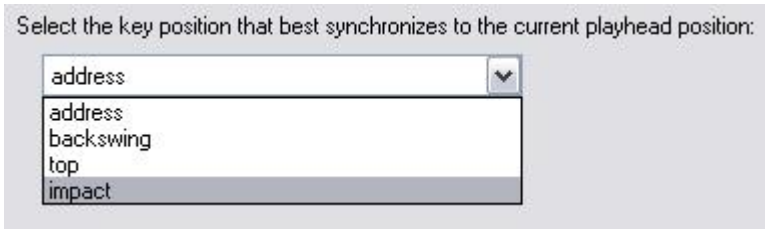
To import key positions:

1. Load the clip to analyze.
2. Position the playhead (e.g. at the impact of the golf club with the ball).
3. Find a "reference" clip in your library.
4. If needed, switch to the *Key Positions* view.
5. Drag and drop the reference clip from the *Items List* onto the key positions (see the paragraph below to learn about a different method of loading the reference clip).



The *Insert Key Positions* dialog opens.

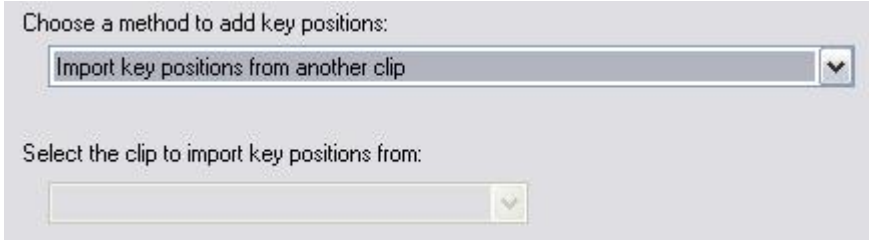
6. The list of key positions of the reference clip is contained in a drop-down list. Select the one that best synchronizes to the current playhead position (e.g. impact).



Another way to select the reference clip:

1. Select *Add Key Positions Automatically...* from the key positions options

2. In the *Insert Key Positions* dialog, select *Import key positions from another clip*.



3. If the reference clip is already loaded in the *Analyzer*, it will be listed in the 2nd drop down list (see illustration above). If it is not listed, you can use the *Browse for clip* link and locate the reference clip on your hard disk.

To edit key positions:

Simply navigate through the imported key positions by clicking them. If needed, modify their position by using the *Move the key position backward/forward in time* buttons:

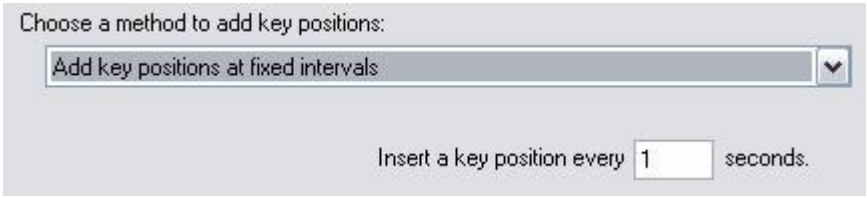
You may have to edit imported drawings and comments (see Adding and modifying drawings).

1.3.4.5 Adding key positions at a fixed interval

You can automatically create key positions at a fixed interval. To do this:

1. Position the playhead where the first key position will be added.
2. From the *Key Positions Options,* select *Add Key Positions Automatically...*

3. In the *Insert Key Positions* dialog, select *Add key positions at fixed intervals*, and set the interval (as a fraction of a second)



! The minimum interval is 0.1 sec.

1.4 Comparing performances

A performance can be analyzed by comparing it to another one, for example to see how an athlete evolves over time, or to a "reference" to highlight how a movement should be performed. You can also analyse a performance viewed from different angles at the same time.

Performances can be compared in *Split-screen* or in *Blend* mode (overlayed on top of each other). Most of the tools described in section Analyze a performance can be used when comparing performances.

1.4.1 Loading multiple clips

You can analyze clips individually or in groups of up to 4 clips at a time. The clip selection buttons - A, B, C and D - correspond to the multiple clips that you can load into the *Analyzer*. In other words, you can compare a performance (loaded in A) with up to 3 other performances in the following ways:

- separately - A vs. B, A vs. C or A vs. D (2-way split, or blend mode).

- simultaneously - A vs. B vs. C (3-way split) or A vs. B vs. C vs. D (4-way split).

To load a clip:

1. Click on one of the selection buttons (A, B, C or D). The button appears to be pushed in.
2. Drag & drop (or double-click) the clip from the *Items List* (or the *Tray*) onto the *Analyzer*'s screen. The clip's first frame is displayed, and its name appears in the timeline underneath the screen.

To load additional clips, repeat step 2 and 3 above but make sure to select a letter for which no clip has been already loaded.

To change a clip (A, B, C or D)

Drag & drop the new clip from the *Items List* to the desired A, B, C or D area.

! Double-clicking on a new clip will not replace an existing clip but will create a new *Storyboard* item. Use the drag & drop method to change a clip.

1.4.2 Display modes

The display mode of each *Storyboard* item can be changed to *Split-Screen* or *Blend* to compare performances side-by-side or overlayed on top of each other. To change the display mode:

1. Select the storyboard item you wish to analyse in split-screen or in blend mode.
2. Activate the desired mode:

 *Split-Screen mode*, or

 *Blend mode*

The storyboard item display changes accordingly. In the illustration below, the second *Storyboard* item has been selected and the split-screen mode activated.

3. Select the clips to analyze by clicking the corresponding buttons - A, B, C or D. The buttons appear as "pushed". To de-select a clip, click on the corresponding button.

To load or change a clip in split-screen or blend modes

- *Split-Screen* mode: drag & drop the new clip from the *Items List* onto the appropriate screen area (A, B, C, or D). If needed, click on the A, B, C or D buttons first.
- *Blend* mode:
  1. Click the corresponding clip button - A, B, C or D. The letter is highlighted in white.
  2. Drag & drop the new clip in the *Analyzer* screen.

1.4.3 Synchronizing video clips

To make the images in the different clips comparable, you need to synchronize their action so that you are comparing relatively similar action within the performances. You can synchronize video clips by using the key positions (see next section) or by using the timeline(s).

Method A: using the Timeline

1. Load two clips in split-screen (see sections Loading multiple clips and Display modes)
2. Click anywhere in the clip displayed on the left of the screen (most likely clip A). A blue timeline shows underneath the screen. Note that timelines are color-coded according to the display screen; blue corresponds to letter A.
3. Drag the *Playhead* to the position where the clip should be synchronized (e.g. at the impact)
4. Click the clip on the right of the screen (most likely clip B). A yellow timeline replaces the blue one.
5. Click and drag the yellow timeline forward or backward (NOT the playhead) until the two clips are synchronized (e.g. when both clips are at the impact).

   Use the [shift] + [left] (or [shift] + [right]) arrow to fine tune the synchronization. This moves the timeline one frame backward or forward.

To play the synchronized clips, click on the *Stop* button to move the *Playhead* to the beginning of the play range and click the *Play* button.

Method B: using the Timline tab

You can use the *Timeline* view to synchronize clips. Click on the corresponding tab to display this view.

The synchronization process is the same as described above except that you do not need to click a clip to select the blue or yellow timeline. You can directly click on a timeline to select it. This view also allows for quick re-synchronization. Simply move the playhead to a new position and adjust the timelines to re-synchronize at the new position.

1.4.4 Synchronizing at key postions

If you have added key positions to the clip(s) (see Adding key positions), you can synchronize performances at every key position for which the labels match. For example, if you consistently use the label "impact" when the club hits the ball and "top" for the position that corresponds to the end of the back swing, it will be very simple to re-synchronize two clips at "impact" or at "top".

You can synchronize clips by matching key positions with the same label. To do this:

1. Load two clips in split-screen.
2. Switch to the *Key Positions* view. Say that both clips contain a key position with the label "impact" at the position where the club hits the ball. Labels must exactly match (see Editing key positions to find out how to edit key position labels).
3. Double-click on the key postion "impact".

This method allows very fast re-synchronization at every matching key position.

If you add key positions to a clip by importing them from a reference clip (see Importing key positions), it will be very easy to synchronize both clips because labels are imported from the reference clip and so exactly match.

If the clips contain multiple key positions, you can synchronize them at a particular position by a double click and navigate through the other key positions by a single-click and observe the relative position of the performers. For example, if you have a key position at every gate of a giant slalom it will be easy to see the distance gained or lost by a skier between each gate.

1.4.5 Setting default synchronization

In the previous topics in this section you have learned that it is possible to synchronize clips at various positions. It is also possible to set a default synchronization position. This is a single *Key Position* at which clips will automatically be synchronized when the clips are loaded into Analyzer's *split-screen* mode.

This saves time resynchronizing clips that are repeatedly compared.

To set default synchronization

1. Add a key position at the chosen video position.
2. Right-click while pointing at the key position and select *set as default synchronization* from the quick menu.
3. The default synchronization key position which shows the is marked with a yellow dot as shown below.

1.4.6 Analyzing in split-screen mode

Analyzing in split-screen is very similar to analyzing in single-screen. However, there are minor differences that you should know about.

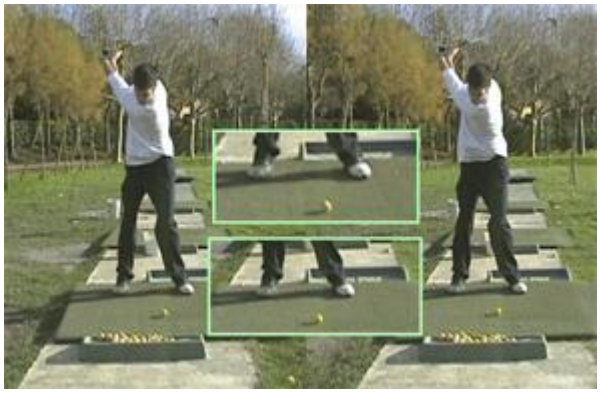
Drawings

Select the appropriate drawing mode (in the drawing toolbar)

- *Video Drawing* - drawings will be applied to either clip A, B, C or D. Simply select a drawing tool and apply it on A, B, C or D.

- *Screen Drawing* - drawings are applied onto the whole *Analyzer* screen.

This means that the drawings can go across the A, B, C or D boundaries. In the example below, the *Clone Rectangle* drawing tool and the *Screen Drawing* mode have been used.



Zoom in/out

You can apply the *Zoom Tool* in any of the A, B, C or D clips. Simply click on the corresponding area to zoom it.

Flip horizontal or vertical

To use this function (see Enhancing images) in split-screen, you first have to select the video (A, B, C, or D) by clicking on the corresponding area. The timeline changes to the A, B, C or D color. Then, use the *Flip Horizontal* or *Flip Vertical* buttons to apply the effect.

1.5 Key position mosaic

Analyzer's *Mosaic* view offers a method of displaying Key Position images on the video display screen. This offers the following benefits:

- Have an at-a-glance view of a performance key moments

- Analyse a performance in between key positions. Key Positions can be displayed beside the video image as it plays. In the example below the video is displayed in the middle of two key positions. Playing the video shows how the performer reached the key position on the right starting from the one on the left.

- Analyzer's drawing tools can be used to annotate and illustrate the *Mosaic.*

1.5.1 Activating the mosaic

Activate the Mosaic by clicking on the *Mosaic* button towards the top left of the Analyzer module.

Once activated, there are several Mosaic layouts to choose from. Click the *Next/previous Mosaic Layout* button to navigate between layouts.

The Mosaic mode is used in conjunction with the other Analyzer display modes; *Single/Split-screen* and *Blend* (see display modes in the Comparing performances topic). Different mosaic content will be displayed depending on which one of these is selected.

- Not all Mosaic layouts include the video clip.

- If there are more key positions than can be displayed with the selected Mosaic layout, the key positions will display dynamically, this means that as the *Playhead* moves along the *Timeline*, the closest set of key positions to the current video position will be displayed.

1.5.2 Drawing on the mosaic

The Drawing tools can be used to annotate the Mosaic, however it is important to note that although the *Video Drawing* tools may be used to draw on the video clip, only the *Screen Drawing* tools may be used to draw on the Key Position images. Drawings extending from the video to a key position or from one key position to another must also be made with the *Screen Drawing* tools.

To learn more about using drawing tools see Drawing on the video and Analyzing in split-screen mode.

Saving Mosaic Images

The Mosaic layout and any drawings that it contains can be saved as a still image (BMP or JPEG) using the *Snapshot* button found immediately below the video display  .

1.6 Next steps

The analysis contained in the *Storyboard* can be published in 3 formats:

1. The *Mediabook* - an interactive multimedia analysis that you can save to a CD-ROM, send via e-mail, or publish on the Internet
2. A printed report - the collection of key position images which can be printed in different layout
3. A new video clip

Read the chapter Publishing analysis to learn more about publishing.

StroMotion & Simulcam are Dartfish's special effects allowing you to view movement in unique ways:

- Read the topic SimulCam & SimulCam fixed to learn how to place two performers together in the same place and time.
- Read the topic StroMotion & StroMotion Fixed to learn how to brake down motion of a performer in a panoramic still image or a video clip.

InTheAction is a tool that is designed to make analysis possible during training. InTheAction shares Analyzer features such as split-screen and blended comparison of video and the ability to add drawings. Read the Chapter Live capture & instant replay during training to learn more about InTheAction.

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