

The movie15 Package

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Abstract

A L^AT_EX package for inclusion of movies, sounds and 3D objects into PDF documents with PDF-1.5/1.6 compatibility.

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1 Introduction

The way multimedia content, i.e. movies and sounds, is included into PDF has changed with Adobe's PDF specification, version 1.5. PDF-1.5 supports a larger variety of movie and sound formats, limited only by the number of plug-ins available for Adobe Reader[®]. With PDF-1.6, support for 3D objects, stored in the U3D file format, has been added. See Table 1 for a list of viable

media formats. The specification allows media file contents to be completely embedded into the PDF output, thus producing self-contained PDF documents.

This package provides an interface to embed movies, sounds and 3D objects into PDF documents for use with L^AT_EX as well as pdfL^AT_EX. Media file contents is incorporated into PDF output by default. This is done either directly during source processing using pdfL^AT_EX or during conversion from Postscript to PDF using Ghostscript's `ps2pdf`.

The final PDF output can be viewed with Windows[®] and Mac OS[®] versions of Adobe Reader. However, embedded media file data can also be extracted and saved to disk from within Readers which support file attachments. This makes PDF documents a little more portable to Readers which do not ship with a multimedia plug-in.

2 Installation

The file ‘movie15.sty’ should be stored in a place where L^AT_EX can find it.

3 Using the package

Invoke the package by putting the line

```
\usepackage[<package options>]{movie15}
```

to the preamble of your document, i.e. somewhere between `\documentclass` and `\begin{document}`.

‘movie15’ takes the option ‘3D’. It enables the 3D feature from the PDF-1.6 specification. Inclusion of 3D files into PDF is discussed separately in section 5.2.

Currently, there are no further options.

If PDF is generated via DVI and Postscript by the usual `latex` \rightarrow `dvips` \rightarrow `ps2pdf` sequence of commands, the ‘graphicx’ and ‘hyperref’ packages are required and must be loaded *after* ‘movie15’.

In the case of pdfL^AT_EX, the ‘graphicx’ and ‘hyperref’ packages are not required.

Note that more than one run may be necessary to resolve internally created cross-references. Appropriate warnings will be issued in such cases.

4 Requirements

pdfL^AT_EX, version ≥ 1.20 , is needed for direct PDF output.

If the package option ‘3D’ is set, ‘movie15’ loads Michael Mehlich’s ‘fp’ package for fixed point arithmetic. Since it does not belong to the core packages of most T_EX distributions it must be installed prior to selecting the ‘3D’ option.

Adobe Reader, version 6, is required for playing movies and sounds, version 7 for rendering embedded 3D content. Unfortunately, only Windows and Mac versions of Adobe Reader provide the necessary plug-ins.

5 The user interface

5.1 Media inclusion

Movies, sounds and 3D objects are embedded into the document using the command

```
\includemovie[<options>]{<width>}{<height>}{<media file>}
```

Unless left empty, the `<width>` and `<height>` arguments must be given in valid \TeX dimensions. Horizontal and vertical dimensions of the media clip are scaled independently to fit `<width>` and `<height>` or, if the two latter are empty, to fit the size of the text box, given as argument to the `'text'` option (see below). `<media file>` specifies the file name of the media clip. If the media file is embedded as part of the final PDF output, which is the default, it may reside wherever \TeX or Ghostscript search for input files, depending on the PDF producing method.

Below, common options to `\includemovie` are listed. Options specific to embedding of 3D content are discussed separately in section 5.2.

`attach[=false]`

By default, the embedded data stream is re-used as embedded file attachment. This makes 'movie15' a little more portable to PDF Readers which do not have a multimedia plug-in because it gives the user the opportunity to extract the media file and to save it to disk for later playback with an external player. However, support of file attachments is required. Re-use as file attachment can be suppressed with option `'attach=false'`. Note that `'attach=false'` is a poor method to prevent the user from obtaining a copy of the media file. There are several (free) tools for decompressing and extracting stream objects from PDF files.

`autoclose`

Close the media player when the page is closed. Use of this option may be necessary for streamed media, such as Real Video.

`autopause`

Pause playing when the page is closed.

`autoplay`

Start playback of the media clip after the page has opened. This is especially useful if there are multiple movie clips on the current page to be played at the same time. Also resumes playback of previously paused media. In the case of embedded sound being started this way, `<width>` and `<height>` can safely be set to ‘0pt’ since no further user interaction is necessary to start playing.

autostop

Stops playing but keeps the media loaded when the page is closed. The media is rewound to its beginning or its ‘startat’ position. This option is set by default if neither of the options ‘autopause’, ‘autoclose’ or ‘continue’ is set.

autoresume

Resume previously paused playback when the page is opened again.

continue

Continue playback in background on premature page change. However, paused media remain paused. So do media that have reached the end or that still show the poster.

controls[=true|false]

Player specific controls are displayed during playback of the media clip, if available. For movies and sounds the default is ‘false’; controls are not shown. For 3D content, the default is ‘true’, since ‘false’ would make the 3D content non-interactive, i. e. not responsive to mouse interaction.

depth=<depth>

Specifies how far the media display area should extend below the bottom line of the running text. Any valid T_EX dimension is accepted.

externalviewer

Opens and plays the media in an external application.

inline[=false]

Media file *data* are embedded into PDF output by default. This can be suppressed with option ‘inline=false’.

label=<label spec>

The media is labelled with `<label spec>` such that it can be referenced by the `\movieref` command elsewhere in the document. The `\movieref` command creates a hyperlink to either stop, pause, resume the media, to play it with different settings, such as frame rate or volume, or to show a different part of it. See section 5.3 for details. `<label spec>` may consist of any sequence of letters, digits or punctuation characters.

`mimetype=<mimetype>`

According to the PDF specification, the viewer application needs to know the MIME type of `<media file>`. Package ‘movie15’ tries to make a guess from the file name extension. If, however, a media file is of unknown type or has a non-standard file name extension, its MIME type must be explicitly specified using this option. See Table 1 for a list of known file name extensions.

`mouse[=true|false]`

Enable mouse interaction: Clicking onto the media (giving it the focus) pauses the playback while clicking outside resumes it. Alternatively, once the media has got the focus, repeated pressing of key ‘P’ on the keyboard switches between Play and Pause (at least with some players).

`palindrome[=true|false]`

The media is played forward and backward, if supported by the media player. In combination with option ‘repeat’ this forward-and-reverse playback repeats as many times as specified. Each complete forward and reverse playback counts as one repeat.

`playerid=<playerid>`

Forces a particular media player plug-in to be used instead of the default one. Currently, the following values are recognized:

- AAPL_QuickTime
- MACR_FlashPlayer
- RNWK_RealPlayer
- MSFT_WindowsMediaPlayer
- ADBE_MCI (Adobe builtin player)

`poster`

The first frame of the movie or the frame at the beginning of the movie section specified by the ‘startat’ and ‘endat’ options is shown.

`poster=<image>`

Inserts still image from file `<image>` to be shown when the media clip is not activated. The file type of `<image>` depends on the output driver: PS or EPS when using \LaTeX together with `dvips`; PDF, PNG or JPEG when using `pdf\text{\LaTeX}`. This option is obsolescent and should not be used any longer. Instead, use option ‘text’ if a still image from an external file is to be inserted. See option ‘text’ for a possibility to scale the media display area according to the poster image dimensions.

`rate=<rate>`

`<rate>` specifies the playback rate, where 1 is normal playback, 0.5 is half speed, 2 is double speed, -1 is normal speed in reverse etc.

`repeat [= <repeats>]`

Playback of the media clip will be repeated `<repeats>` times. Without argument this option causes the player to repeat forever.

`startat=<offset>`
`endat=<offset>`

Start/stop playback at the specified offsets. `<offset>` may be an absolute time or frame value, or a named marker, or a marker plus a time or frame. In the latter case, time or frame values are regarded as relative to the named marker. Support of markers, time and frame offsets is media type dependent. Media incompatible offsets are ignored. The following syntax applies to `<offset>`:

```
time:<time in seconds>
frame:<frame number>
marker:<quoted string>
```

Some `<offset>` examples:

```
time:20.5
frame:100
{marker:"Chapter 1", time:60}
```

`text=<text>`

`<text>` is typeset onto and centred within the media display area which has been specified by the `<width>` and `<height>` arguments as well as the `'depth'` option. If either or both of the `<width>` and `<height>` arguments are left empty, any unspecified dimension of the media display is scaled to match the corresponding dimension, i. e. width and height, of `<text>`. Likewise, the depth of the media display is adjusted to the depth of `<text>` if the optional `'depth'` has not been given. Therefore, option `'text'` can be used to scale the media display to the natural or scaled dimensions of a poster image file, such as (requires package `'graphicx'`; *also note the empty `<width>` and `<height>` arguments!*):

```
\includemovie[text={\includegraphics[scale=2]{path/to/poster}}]
{}{}{path/to/movie}
```

In combination with the `'poster'` option, where the poster image will be rendered from the movie during runtime, the PDF file size can be reduced somewhat by putting `\includegraphics` into a `\phantom` box:

```
\includemovie[
  poster,
  text={\phantom{\includegraphics[scale=2]{path/to/poster}}}
]{}{}{path/to/movie}
```

`textoverposter[=false]`

Set this option to ‘false’ if you wish `<text>` to be obscured by the external poster image which has been inserted with the poster option. Deprecated.

`url`

Treat `<media file>` as URL. Sets option ‘inline’ to ‘false’ automatically.

`volume=<percentage of original volume>`

The meaning of this option should be self explaining.

5.2 Inclusion of 3D objects

The PDF-1.6 specification, which was introduced with the advent of Adobe Acrobat/Reader 7, allows embedding of 3-dimensional graphic objects, such as CAD models or 3D scientific data, and lets the user interactively manipulate them. At time of writing this documentation, the only supported file format is U3D [2], and only one commercial software [3] for exporting into U3D format, yet from a number of CAD and 3D vector formats, including DXF and VRML, was known. Nevertheless, a try-out version of [3] can be downloaded from the Web site.

Selection of the ‘3D’ package option enables the 3D feature. Most of the command options listed in section 5.1 do what they are supposed to do in the case of embedded 3D as well. Other options are ignored, in particular ‘repeat’, ‘palindrome’, ‘startat’, ‘endat’, ‘rate’ and ‘volume’, because they do not make sense and ‘mouse’, because 3D objects are interactive by definition. Options ‘inline=false’ and ‘url’ are supported, but imply option ‘externalviewer’, because the 3D Reader plug-in handles embedded files only.

There are a few options to `\includemovie` which define how the 3D object is positioned within the viewport of a virtual camera, or conversely, how the virtual camera is positioned and oriented within a coordinate system, called ‘The World’, which bears the 3D object at a fixed position. Fig. 1 should help to visualize the scenery: The virtual camera is orbiting at a distance of ROO around the centre of orbit, specified by the position vector \overrightarrow{COO} ; $\angle AAC$ is the camera’s aperture angle. In addition, the direction vector $\overrightarrow{C2C}$ is needed to specify the initial camera position.

The *default view*, i. e. the view that is shown initially after activating the 3D object in the Reader, can be set using the options ‘3Dcoo’ for the centre of orbit, ‘3Dc2c’ for the centre of orbit to camera vector, ‘3Droo’ for the orbital radius and ‘3Daac’ for the aperture angle of the camera:

`3Daac=<angle>`

This option sets the aperture angle of the camera, measured in degrees. Fixed point real numbers between 0 and 180 are admissible. A sensible value of 30 is preset by default. Larger values can be used to achieve wide-angle or fish-eye effects, see example 3 in section 6.

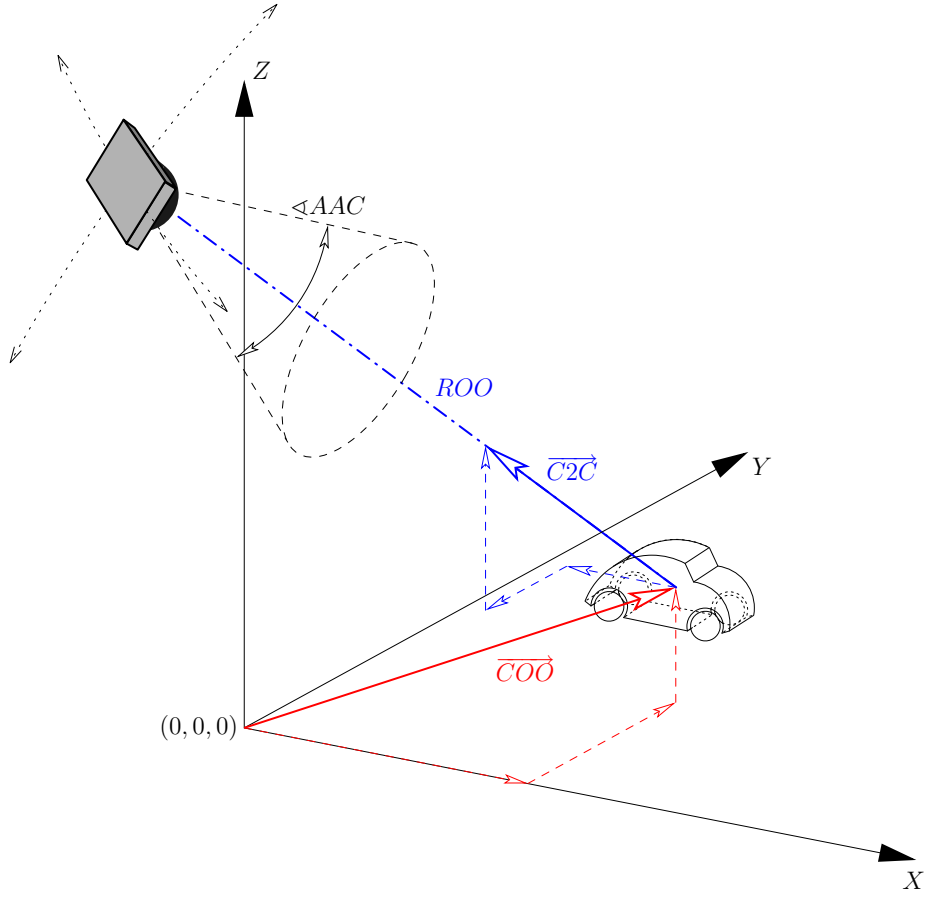


Figure 1: Camera and 3D object in the World System XYZ ; centre of orbit position vector \vec{COO} , centre of orbit to camera direction vector $\vec{C2C}$, radius of orbit ROO , aperture angle of camera $\angle AAC$.

$3Dc2c=<x> <y> <z>$

$<x> <y> <z>$ specify a direction vector $\vec{C2C}$ of arbitrary length, originating in the centre of orbit and pointing to the virtual camera. Only fixed point numbers in the range from

−999999999999999999.999999999999999999

to

+999999999999999999.999999999999999999

are allowed.

$3Dcoo=<x> <y> <z>$

$<x> <y> <z>$ specify the positional vector \vec{COO} of the centre of orbit. See option '3Dc2c' for the number format of $<x> <y> <z>$.

$3Droo=<r>$

`<r>` (always positive!) specifies the radius of orbit ROO of the virtual camera. See option ‘3Dc2c’ for the number format of `<r>`.

Without the above options the immovable camera sits at the origin $(0,0,0)$ of the World, looking in the positive Y direction, i. e. default settings of `3Droo=0`, `3Dcoo=0 0 0` and `3Dc2c=0 -1 0` are assumed. (Note that $\overrightarrow{C2C}$ is the opposite of the view vector!)

Thus, in order to get a ‘front view’ of the 3D object it is sufficient to gradually increase the radius ROO from \LaTeX run to \LaTeX run until the object or group of objects can be fully seen in the viewport. Since the object size in terms of world coordinate units may differ in orders of magnitude between U3D files, the optimal ‘3Droo’ setting might be found by experimenting with a series of geometrically increasing numbers, such as 1, 10, 100, 1000, 10000 etc. to get a rough approximation and by subsequent fine tuning using smaller changes.

Ideally, there should be no need for changing the default setting of `3Dcoo=0 0 0` for the centre of orbit. However, this requires that the 3D object or group of objects be centred around the world origin $(0,0,0)$ during file export into U3D format. (This is the default setting with [3].) If the 3D object apparently pivots around an orbital centre that lies outside of the object’s cubature, either the file export could be repeated with appropriate settings or the centre of orbit could be moved into the object centre using the ‘3Dcoo’ option. Regarding the latter method, this can be easily achieved if the object is examined from two different directions, say from left (`3Dc2c=-1 0 0`) in order to adjust the `<y>` and `<z>` coordinates of ‘3Dcoo’ and from front (`3Dc2c=0 -1 0`) in order to adjust the remaining `<x>` coordinate.

Alternatively, good values for the ‘3Droo’ and ‘3Dcoo’ options can be found easily by temporarily inserting a hyperlink using the `\movieref` command together with the ‘3Dcalculate’ option. See section 5.3 for an explanation and example 3 in section 6.

`3Dviews=<views file>`

Instead of or in addition to the default view, further *named views* can be set in an auxiliary file specified by the ‘3Dviews’ option. The additional views can later be selected from a drop down list in the tool bar that is associated with every activated 3D object in the Reader. The file `<views file>` contains lines which obey the syntax:

`[<name>]{<coo_x> <coo_y> <coo_z>}{<c2c_x> <c2c_y> <c2c_z>}{<roo>}{<aac>}`

The `<name>` entry is optional. If `<name>` is not given, a default name consisting of ‘View’ followed by the number of the current entry in the list is formed. For `<coo_x>`, `<coo_y>`, `<coo_z>`, `<c2c_x>`, `<c2c_y>`, `<c2c_z>`, `<roo>` and `<aac>` the same rules as for the corresponding options ‘3Dcoo’, ‘3Dc2c’, ‘3Droo’ and ‘3Daac’ apply. Trailing spaces or comment signs (%) are allowed. Reading of the file stops either at its end, at the first empty line encountered or at the first line containing nothing but spaces and/or a comment sign followed by arbitrary stuff.

3Dbg=<r> <g>

This option sets the background colour of the canvas. Only fixed point real numbers in the range from 0 to 1 are allowed for the colour components.

3Djscript=<JavaScript file>

Things like animation, lighting, background colour etc. may also be script driven. Option '3Djscript' associates a <JavaScript file> with the 3D object. The script will be executed upon activation of the object. Refer to the Acrobat 3D JavaScript Reference [4] for details.

5.3 Media hyperlinks

A movie, sound or 3D object may serve as the destination of hyperlinks, which are inserted into the document using the command

```
\movieref[<options>]{<label spec>}{<text>}
```

It makes <text> a hyperlink to the media that has been labelled with <label spec> using the 'label' option of the \includemovie command. Media hyperlinks can be inserted at any location within the document. Clicking onto the hyperlink causes the Reader to open the page containing the media it is pointing to. The primary purpose of media hyperlinks, however, is to provide a means to control the playback.

In 2D context, clicking onto the hyperlink causes the media to stop, pause or resume, or to restart at different settings, such as frame rate, volume, starting and ending positions, depending on the <options> being in effect.

Options that control the playback *characteristics* are: 'controls', 'endat', 'mouse', 'palindrome', 'rate', 'repeat', 'startat' and 'volume'. Their meaning is the same as for the \includemovie command and can be looked up in section 5.1. They take effect in combination with the 'play' option only.

The options which follow let the hyperlink change the playback *state* of media. If none of them is specified, 'play' is assumed.

play

Immediately closes the media and restarts playback. If new playback settings have been specified through the options given above, they override the original settings being in effect during media inclusion.

stop

Stops and rewinds the media to its beginning or to the 'startat' position.

resume

Resumes paused media. In fact, this option makes the hyperlink a toggle switch: repeated clicking switches between paused and resumed state.

pause

Has the same effect as option ‘**resume**’. Added for completeness only.

reset

Revert to the original settings which were in effect during media inclusion.

close

Immediately closes the media player.

In 3D context, `\movieref` can be used to define an additional view of the object, to access a particular view from the list of predefined views or to run a JavaScript. Moreover, a link can be created for calculating the camera settings ‘3Droo’ and ‘3Dcoo’, instead of finding them manually. The following options are recognized:

`3Dviewindex=<index>`

Go to a predefined view of the 3D object. `<index>` can take ‘F’, ‘L’, ‘N’ or ‘P’ to access the first, last, next or previous element of the list of additional views, cf. option ‘3Dviews’ of `\includemovie`, or an integer specifying an index into the list. In the case of ‘N’ and ‘P’, repeated clicking onto the hyperlink allows to cycle through the list in forward or backward direction. ‘D’ gives access to the default view.

`3Daac=<angle>`

`3Dc2c=<x> <y> <z>`

`3Dcoo=<x> <y> <z>`

`3Droo=<r>`

Instead of referencing an existing view of the 3D object, a new one can be defined using any of these options, cf. section 5.2.

`3Dcalculate[=<aac angle>]`

Creates a link for calculating ‘3Droo’ and ‘3Dcoo’ settings of the virtual camera. Clicking the link opens a dialogue box from which the settings can be copied to the clipboard for later insertion into the option list of `\includemovie`. The default aperture angle of 30° is used for the calculation unless an optional `<aac angle>` has been provided.

`3Djscrip=<JavaScript file>`

Runs the script `<JavaScript file>` after clicking the link. Unlike the script that has been associated with the 3D annotation during object embedding, this JavaScript is not directly run by the JavaScript engine of the 3D plug-in, but is run by Acrobat's own scripting engine. However, full access to the API of the 3D script engine is provided through the `'context3D'` property of the `'Annot3D'` object. For convenience, an associative array `'annot3D'` has been provided for use within `<JavaScript file>`, in order to easily access the `'Annot3D'` object of the annotation the enclosing link is pointing to. The particular element of the array is referenced by the annotation's label `<label spec>`, enclosed in quotation marks. As an example, the `'scene'` object can be referenced within `<JavaScript file>` by

```
annot3D["<label spec>"].context3D.scene
```

For details about Acrobat JavaScript and its Annot3D object, see [5].

5.4 Compatibility commands

Two user commands have been provided that make `'movie15'` a replacement for the `'multimedia'` package which is part of Till Tantau's 'Beamer' Class:

```
\movie[<options>]{<poster text>}{<media file>}
```

```
\hyperlinkmovie[<options>]{<label spec>}{<text>}
```

All of the optional arguments to `\includemovie` and `\movieref` can be used with the compatibility macros as well. In addition, they honour the following options:

```
height=<height of display>
width=<width of display>
```

Set the horizontal and vertical dimensions of the media display area (`\movie` only).

```
autostart
```

The same as `'autoplay'`.

```
loop[=<repeats>]
```

The same as `'repeat'`.

```
once
```

The same as `'repeat=1'`.

```
showcontrols
```

The same as ‘controls’.

`start=<offset in seconds>s`

Start playback at the specified temporal offset. The trailing ‘s’ is mandatory.

`duration=<duration in seconds>s`

The duration of the media segment to be played. The trailing ‘s’ is mandatory. Note that ‘duration’ cannot be used together with option ‘startat’ from `\includemovie`. In order to define a media segment options can be combined as follows: ‘startat’/‘endat’, ‘start’/‘endat’, ‘start’/‘duration’.

6 Examples

1. A short circular MPEG movie, taken from <http://www.linux-video.net/Samples/>

```
\includemovie[
  poster,
  text=(random.mpg),
  mouse,
  repeat
]{
  .5\linewidth
}{
  .375\linewidth
}{random.mpg}
```

2. Another MPEG movie, loaded on the fly from <http://www.linux-video.net/Samples/>. Hence, a working Internet connection is required. This time, we force the QuickTime plug-in to be used instead of MediaPlayer (Windows boxes only). Well, the latter seems to be bugged. Quod erat expectandum.

```
\includemovie[
  poster,
  label=alien,
  text=(AlienSong.mpg),
  url,
  playerid=AAPL_QuickTime,
  repeat
]{
  .5\linewidth
}{
  .375\linewidth
}{http://www.linux-video.net/Samples/Mpeg1/AlienSong.mpg}
\movieref[rate=0.5]{alien}{Slow}
\movieref{alien}{Normal}
\movieref[rate=2]{alien}{Fast}
\movieref[pause]{alien}{Pause/Resume}
```

3. Embedded U3D file. It is based on a VRML model by Peter Whitehouse <pwhitehouse@optusnet.com.au>. Conversion to U3D has been made with DeepExploration[®][3]. A file ‘dice.vws’ that provides additional views and a JavaScript ‘dice.js’ defining light sources have been associated with the 3D object.

```

\includemovie[
    poster,
    label=dice,
    text=(dice.u3d),
    3Droo=28,
    3Dc2c=1 -1 1,
    3Dbg=1 1 1,
    3Dviews=dice.vws,
    3Djavascript=dice.js
]{
    .5\linewidth
}
    .5\linewidth
}{dice.u3d}
\movieref[
    3Dviewindex=N
]{dice}{Click here} ...
\movieref[
    3Dcalculate=60
]{dice}{This link} ...

```

Click here to cycle through the list of additional views. This link calculates 3D option settings for a 60° aperture angle of the virtual camera.

References

- [1] Adobe Systems Inc.: *PDF Reference, fifth edition: Adobe Portable Document Format version 1.6*, 2004, Implementation note 144, Appendix H.3, available at: http://partners.adobe.com/public/developer/en/acrobat/sdk/pdf/pdf_creation_apis_and_specs/PDFReference.pdf.
- [2] <http://www.3dif.org/>
- [3] <http://www.righthemisphere.com/products/dexp/>
- [4] Adobe Systems Inc.: *Adobe Acrobat 7.0 3D JavaScript Reference*, 2005, available at <http://partners.adobe.com/public/developer/en/acrobat/sdk/pdf/javascript/Acro3DJS.pdf>
- [5] Adobe Systems Inc.: *Adobe Acrobat 7.0.5 JavaScript Scripting Reference*, 2005, available at <http://partners.adobe.com/public/developer/en/acrobat/sdk/pdf/javascript/AcroJS.pdf>

Table 1: Media formats for use with Adobe Reader (partially from [1])

Extension	MIME type	Description
aif, aifc, aiff	audio/aiff	Audio Interchange File Format
au, snd	audio/basic	NeXT/Sun Audio Format
avi	video/avi	Audio/Video Interleaved
gif	image/gif	(animated) GIF
mid, rmi	audio/midi	Musical Instrument Digital Interface
mov, qt	video/quicktime	Apple QuickTime
mp3, m3u	audio/x-mp3	MPEG Audio Layer-3
mp4	video/mp4	MPEG-4 Video/Audio
mpeg, mpg	video/mpeg	MPEG-1 & 2 Video
ra, ram, rm	audio/x-pn-realaudio	Real Media
smil	application/smil	Synchronized Multimedia Integration Language
swf	application/x-shockwave-flash	(Adobe?) Macromedia Flash
u3d	model/u3d	Universal 3D File Format
wav	audio/wav	MS Audio Format
wma	audio/x-ms-wma	Windows Media Audio
wmv	video/x-ms-wmv	Windows Media Video