

3D Content Creation Guidelines

Philips 3D Solutions

Document Information

Info	Content
Title	3D Content Generation Guidelines
Date	27 November 2006
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Table of Contents

1	Introduction	5
1.1	Scope and Purpose.....	5
1.2	Content creation chain	5
1.3	References	6
2	Editing guidelines	7
2.1	Stretched images	7
3	2D + Z image format	9
4	WOWvx Declipse technology	10
4.1	Using the WOWvx compositor.....	10
4.2	WOWvx Declipse format	11
5	Concatenate images	12
6	Encoding to video file.....	13
7	The s3d File Extension.....	14
	Appendix A: MPEG-2.....	15

1 Introduction

1.1 Scope and Purpose

This document holds guidelines for creating content for the Philips 3D Displays as delivered by Philips 3D Solutions. This document explains step by step, the required actions to make video files, which can be played on a Philips 3D Display. The content will be created for each of the two display types 16:9 for the 42" displays and 4:3 for the 20" displays, the differences will be explained at the appropriate moments.

1.2 Content creation chain

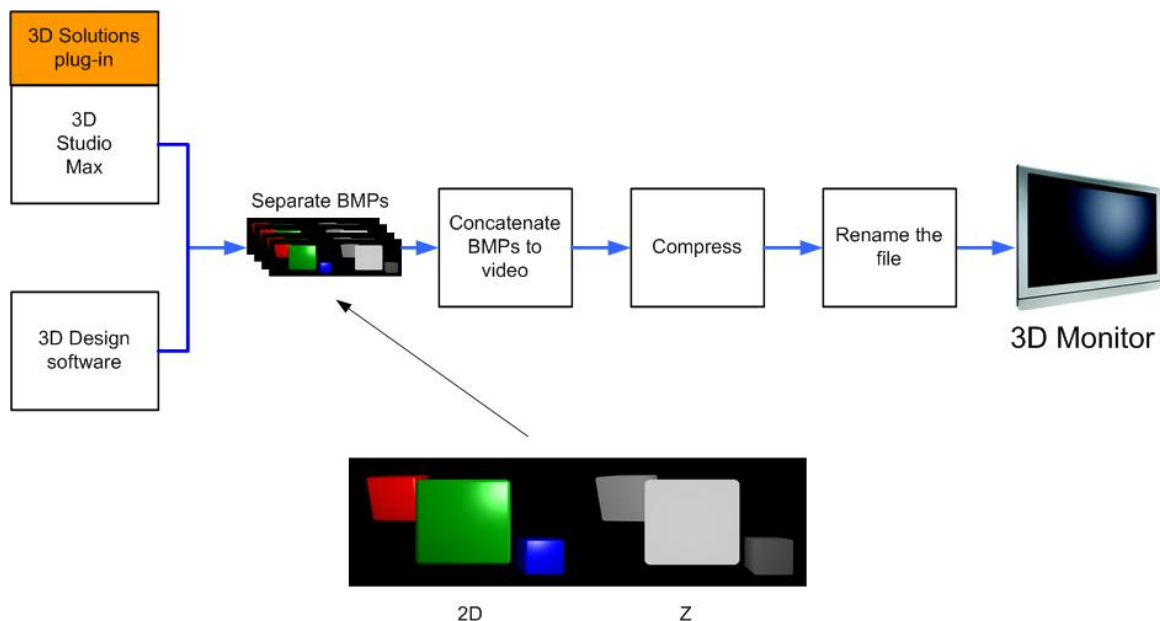


Figure 1: 3D content creation steps

The interface to a Philips 3D Display is based on 2D plus Z. Adjacent to the traditional 2D image a Z image is added, also named depth map. This is an image with the same size as the 2D image. Each pixel of the depth map corresponds to a pixel of the 2D image and indicates the distance of the corresponding 2D pixel to the observer.

Several steps need to be made in order to create content for a Philips 3D Display. 3D Studio Max or any other 3D design software can be used to edit the scene as one is used to do. These tools can generate the 2D + Z images using for instance one of the products from 3D Solutions the 3D Studio Max Plug-in. Finally the images are concatenated to a video file and the video file is compressed.

The new generation of 3DS Media Player also support the playback of images. These images are RGB (24 bit uncompressed) bmp files and have the extension .b3d. (The same images that are written by the 3D Studio Max plug-in.)

The 3D Studio Max plug-in from Philips 3D Solutions makes the transition from creation of traditional 2D content to 3D content very small. At this moment Philips 3D Solutions only provides a plug-in for 3D Studio Max. Content creators who are using other tools should start reading chapter 3 in which the 2D + Z bitmap structure is defined. These content creators should make the bitmaps themselves that fulfils requirements as stated in chapter 3.

When a set of images is ready these should be concatenated and compressed into a video file, see chapters 4 and 6.

1.3 References

For more information on the 3D Studio Max plug-in see its user manual:

3D Studio Max Plug-in
User Manual
Philips 3D Solutions

the user manual:

3DS Media Player
User manual
Philips 3D Solutions

For more information on how to play **s3d** files see

2 Editing guidelines

While working in 3D design software, some design rules must be kept in mind. Section 2.1 describes how to deal with image stretching done by the display.

2.1 Stretched images

If an object positioned at the left edge of the image has a depth that puts it behind the screen, a viewer looking at it from the right would expect to see more pixels to the left of the object where the frame of the display would no longer be concealing the object. Because these pixels are not in the original image, the image is stretched slightly before sending it to rendering to prevent this problem. Figure 2 shows how the image is stretched. Stretching and rendering takes place inside the display.

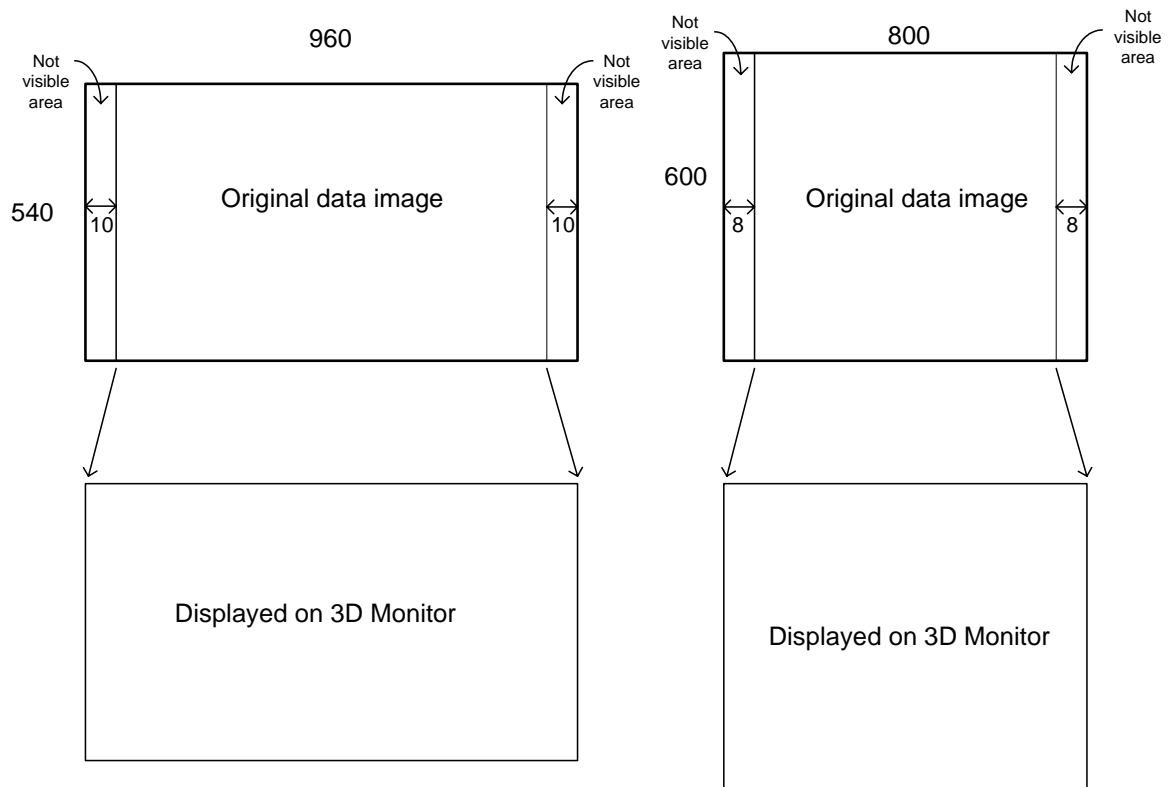


Figure 2: A band at the left and right side of the image data are not displayed on the 3D displays.

For the 16:9 screens the original input data (excluding depth) has a resolution of 960x540. The 10 most left pixels and the 10 most right pixels of each row are not visible on the display, when the depth of the pixels is on the screen. However when the depth is behind the screen, the observer is able to see this information in these bands.

For the 4:3 screens the original input data (excluding depth) has a resolution of 800x600. For the 8 most left and right pixels of each row the same holds as for the 16:9 displays.

So while creating content, the editor must keep in mind that small bands at the left and right side will mostly not be visible. Especially for text and logo's located closely to left and right borders of the screen the placement must be done carefully.

3 2D + Z image format

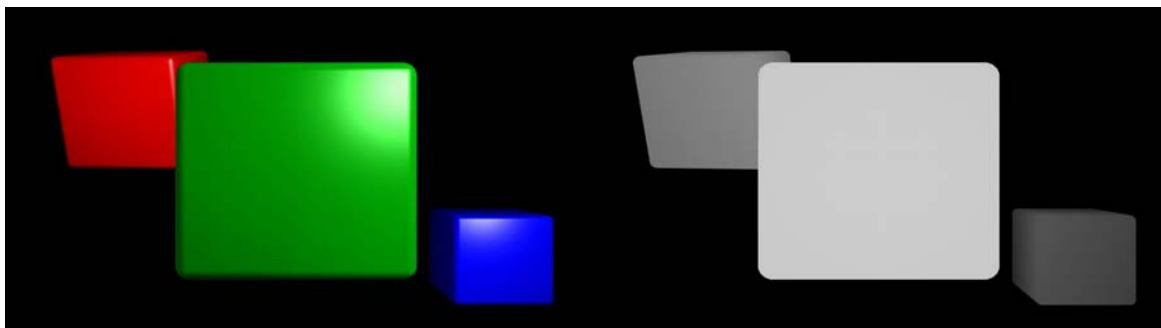


Figure 3: A bitmap, left half 2D, right half Z map.

An 2D + Z image is an ordinary bitmap, which contains RGB and depth information according to a specific arrangement and resolution.

Description	16:9	4:3
The total image has a resolution of	1920 x 540	1600x600
The left half contains a 2D RGB picture with a resolution of	960x540	800x600
The right half contains a depth map in grey scale picture with the resolution	960x540	800x600

The R, G and B bytes of the depth map have the same value, resulting in a grey scale picture.

<u>Depthmap:</u>	255	Close to camera / observer (= Max. value.)
	128	Pixels with the value 128 will be located on the screen
	0	Far away, behind screen (= Min. value)
<u>White chromaticity (for 42")</u>		Wx: 0.285 Vy: 0.293 (at 9300°K)
<u>White chromaticity (for 20")</u>		Unknown at this time.
<u>File extension:</u>		bmp
<u>Image type:</u>		True color (24 bit)

4 WOWvx Declipse technology

4.1 Using the WOWvx compositor

Using the 2D+Z image format a quite astonishing 3D experience can be created. But on locations with large depth differences an undesired effect can be visible in the outer views of the viewing cone. On these locations you should be able so see past an object, but because only one picture is available the information on what should be rendered is not available.

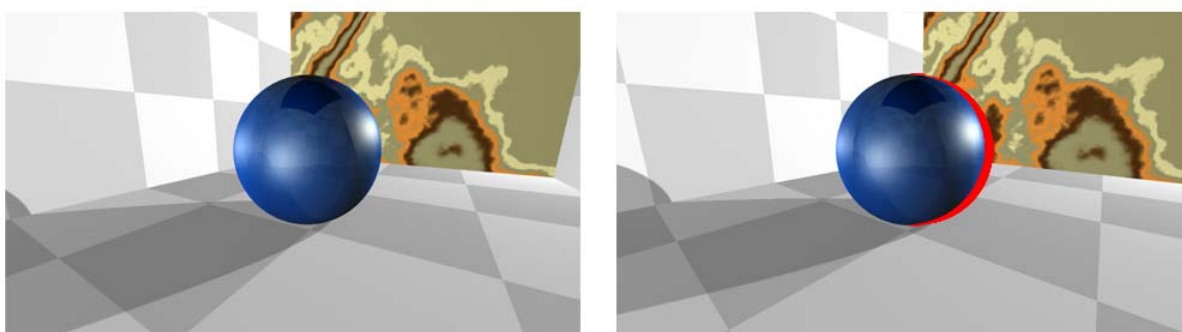


Figure 4 Left and right two views on the same scene. Red denotes missing information.

Figure 4 shows the location in red where the information is missing. As no information is available the rendering algorithm in the WOWvx screen masks this by reproducing the contents of this area based on the surrounding information. To enable a crisper image and better quality the WOWvx Declipse technology was created. With Declipse extra information is added enabling a better 3D experience, the image above would than be visible as in Figure 5.

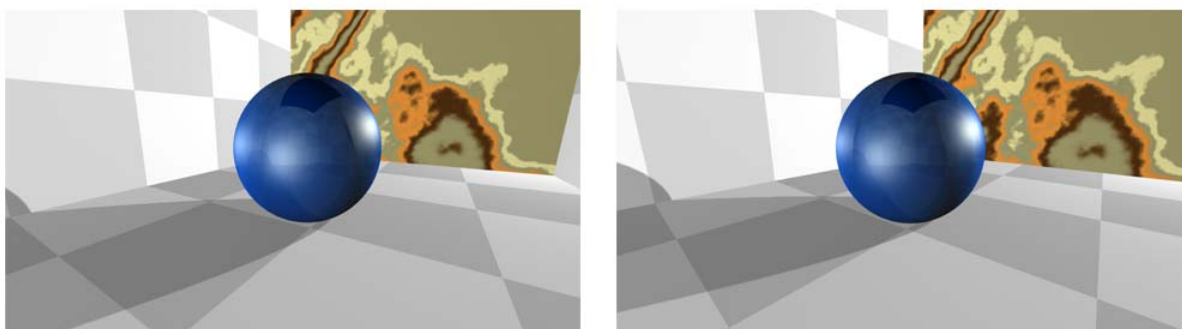


Figure 5 Left and right the same different views with WOWvx Declipse technology

For more information on WOWvx Declipse please see the WOWvx Compositor and its user manual. More information on this tool can be found on <http://www.philips.com/3dsolutions>

4.2 WOWvx Declipse format

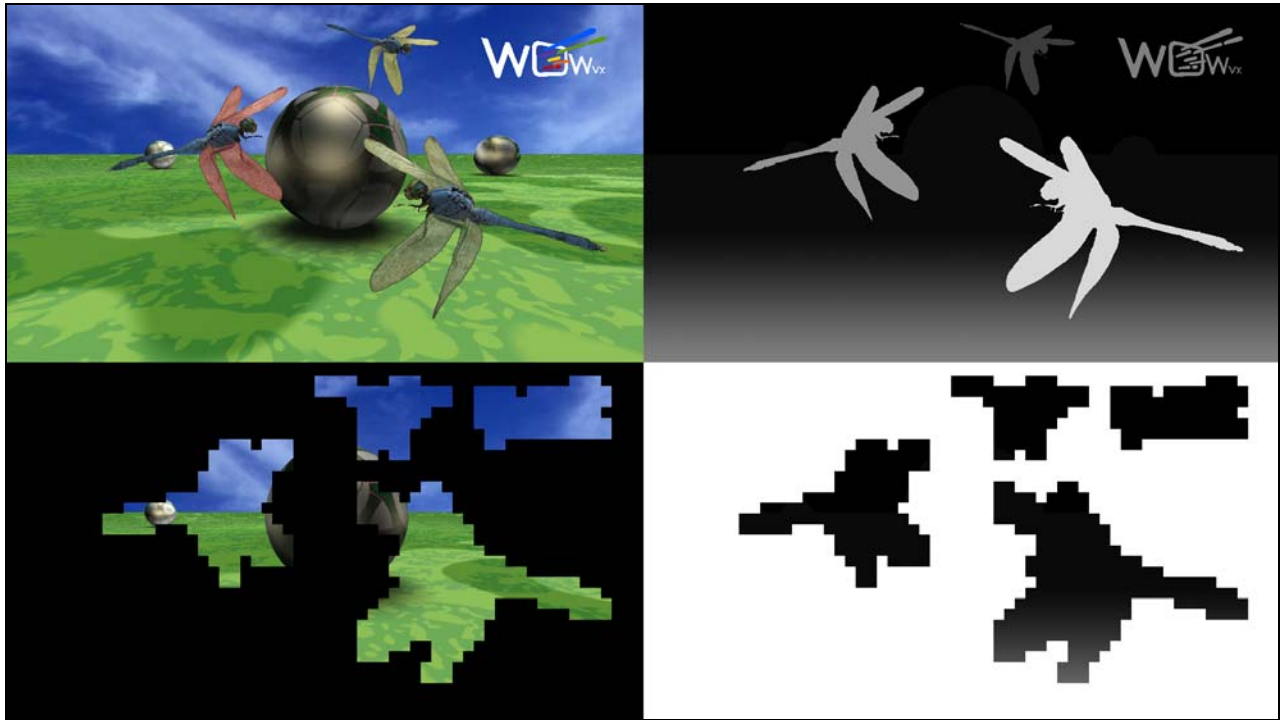


Figure 6 Bitmap showing on top complete 2D image (left) and depth (right). On the bottom background 2D image (left) and depth (right).

The WOWvx Declipse format is an extension on the existing 2D+Z format described in section 3. Information on the background is added enabling the rendering algorithm filling in the occluded areas created by the foreground object. Figure 6 shows the four quadrants that should be supplied to the screen. The quadrants specify the following information:

Description	16:9	4:3
The total image has a resolution of	1920x1080	1600x1200
The top left: a 2D RGB picture with a resolution of	960x540	800x600
The top right: a depth map in grey scale picture with the resolution (This depth map belonging to the top left 2D image)	960x540	800x600
The bottom left: 2D RGB picture of the background with resolution. (On the places where the 2D information is equal to the quadrant above (top left) the 2D information is set to black to avoid encoding redundant data. To obtain optimal compression the information stops at the boundaries of (16x16) macro blocks.)	960x540	800x600
The bottom right: the depth map on the areas occluded by the foreground objects. This depth map relates to the bottom left 2D image (On the places where the disparity is equal to the quadrant above (top right) the disparity is set to maximal (white) to avoid encoding redundant data. To obtain optimal compression the information stops at the boundaries of (16x16) macro blocks.)	960x540	800x600

5 Concatenate images

In this step the separate images (where one image contains both 2D and Depth) are concatenated to an uncompressed avi video. Use Virtualdub (<http://www.virtualdub.org/>) to make an uncompressed avi file. No compression should take place within Virtual Dub. This is also the best place to mix your audio in.

Frame rate: 30 fps

Note: It is best to use the new AVI format (Save as AVI...) as the others can give problems with files larger than 4GigaByte.

6 Encoding to video file

Depending on the application the method and quality of the encoding can differ. Within this document there are two methods described for encoding. The default encoding method is Windows Media Video because this will without extra software play on the system of the customer. Another method MPEG-2 is specified in the appendix needs additional software to be installed by the end-user.

Windows Media Video

For owners of valid Windows XP operating system, the encoder can be downloaded from Microsoft free of charge from:

<http://www.microsoft.com/windows/windowsmedia/9series/encoder/default.msp>

The batch file below assumes that the WMV encoder is installed in its default path. After this encoder is installed you can encode the content using

```
encodewmv source.avi destination.s3d
```

```
@echo off
set WMVPATH="C:\Program Files\Windows Media Components\Encoder\"
set WMENCODER=%WMVPATH%"wmcmd.vbs"
rem Standard WMV video only profile
set VIDEO_QVBR_100=%WMVPATH%"Settings\d6_qvbr_100_video.prx"

cscript.exe %WMENCODER% -input %1 -output %2 -loadprofile %VIDEO_QVBR_100%
```

Figure 7 encodewmv.bat

Please see the help file of the Windows Media Encoder for the other command line options for the encoder. In figure 7 the encodewmv.bat will encode the content with the highest quality possible (ensure that the bit rate is not too high for your application). Other quality settings are possible to e.g. constraint the bit rate as seen in figure 8 which can result in artefacts.

Figure 8 encodewmv_with_peak_of_10Mbit.bat

```
@echo off
set WMVPATH="C:\Program Files\Windows Media Components\Encoder\"
set WMENCODER=%WMVPATH%"wmcmd.vbs"

rem Everything below this comment should be on a single line
cscript.exe %WMENCODER% -input %1 -output %2 -a_codec WMA9PRO
-v_mode 4 -v_bitrate 8000000 -v_peakbitrate 10000000 -v_peakbuffer
80000
```

The batch file shown in Figure 7 does not support audio. In Figure 8 a batch file is shown which does support an AVI input file that contains audio.

7 The s3d File Extension

The s3d file created in the previous chapter is available after WMV encoding. This file can be played on the 3D display. If the content contains a depth map it can be played using the 3DS Media Player giving a depth impression. The depth impression is generated using images from multiple angles. These images are generated by hardware in the 3D Display.

Files using the extension **s3d** are played with the 3DS Media Player. This extension makes sure that the 3DS Media Player sets the 3D Display in 3D mode with the correct settings for signage content.

For more information on how to play **s3d** files see the following document:

3DS Media Player
User manual
Philips 3D Solutions

Appendix A: MPEG-2

It is also possible to create content that is compressed using MPEG-2. Be aware that a MPEG-2 decoder is not installed by default. If no MPEG-2 decoder is installed you can advice GPL MPEG-1/2 DirectShow Decoder Filter (<http://sourceforge.net/projects/gplmpegdec>). Installing multiple MPEG-2 decoders can lead to incompatibility problems between video and audio. Using the WMV format (see chapter 6) results in a playback supported by the Windows XP operating system.

Install Ffmpeg (<http://www.videohelp.com/download/ffmpeggui03c.zip>). The batch files below assume this application is installed in 'C:\tools'. Using these batch files (encode16_9.bat & encode4_3.bat) with the contents as below you can compress the created video file using the command:

```
encode16_9 source.avi destination.s3d
```

or

```
encode4_3 source.avi destination.s3d
```

```
@echo off

"C:\tools\ffmpeg.exe" -i "%1" -hq -vcodec mpeg2video -b 24000 -bt
16000 -aspect 32:9 -s 1920x540 -y "%2".vob
move "%2".vob "%2"
```

Figure 9 encode16_9.bat

```
@echo off

"C:\tools\ffmpeg.exe" -i "%1" -hq -vcodec mpeg2video -b 22000 -bt
15000 -aspect 8:3 -s 1600x600 -y "%2".vob
move "%2".vob "%2"
```

Figure 10 encode 4_3.bat

Some handy parameters:

Parameter	Description	Choices
-acodec	select audio codec	mp1 mp2 (default) ac3
-ab	bitrate in kb/s	-
-r	framerate	

There are some things to take in consideration:

The current compression takes over the frame-rate of the source. When this is out of spec ffmpeg will give an error. Using the `-r` option the frame rate can be set.

The default audio codec is mp2 audio at 64 kb/s. You can set another audio codec using the parameter `-acodec`. Please be aware that the system playing back the created file should have the proper audio codec installed. Currently 3D Solutions does not advise a default audio codec nor bitrate.

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