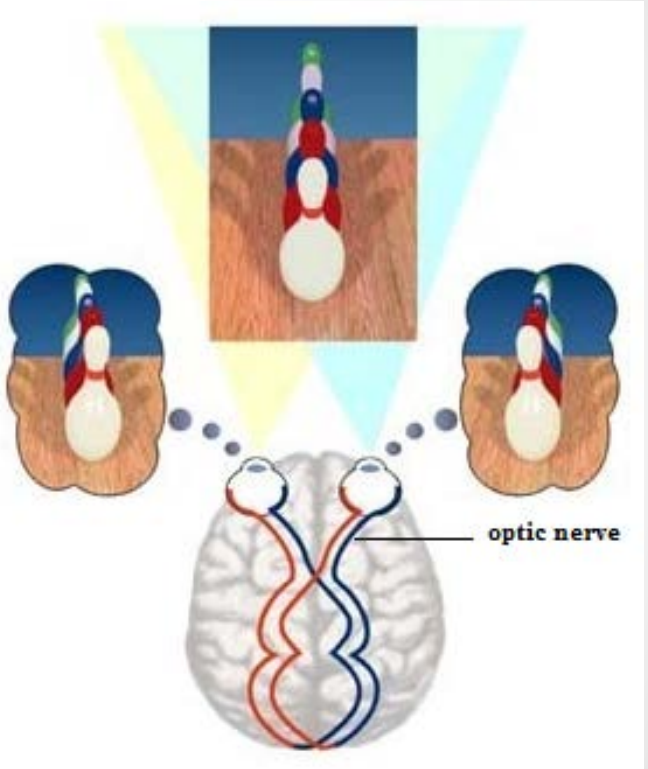
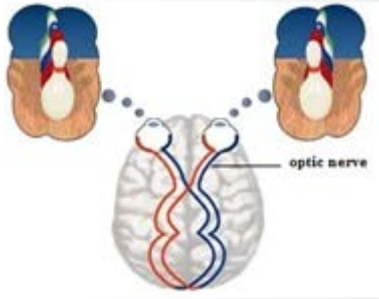
Human visual system

- Two images pass back through the optic nerve to various visual systems, where an incredibly robust real-time analysis of the raw data is performed by several areas of the brain at once. Some areas look for straight lines, some for motion.
- Eventually all this information filters up into your consciousness and you are aware of color, depth, movement, patterns, and distinct objects within field of view.



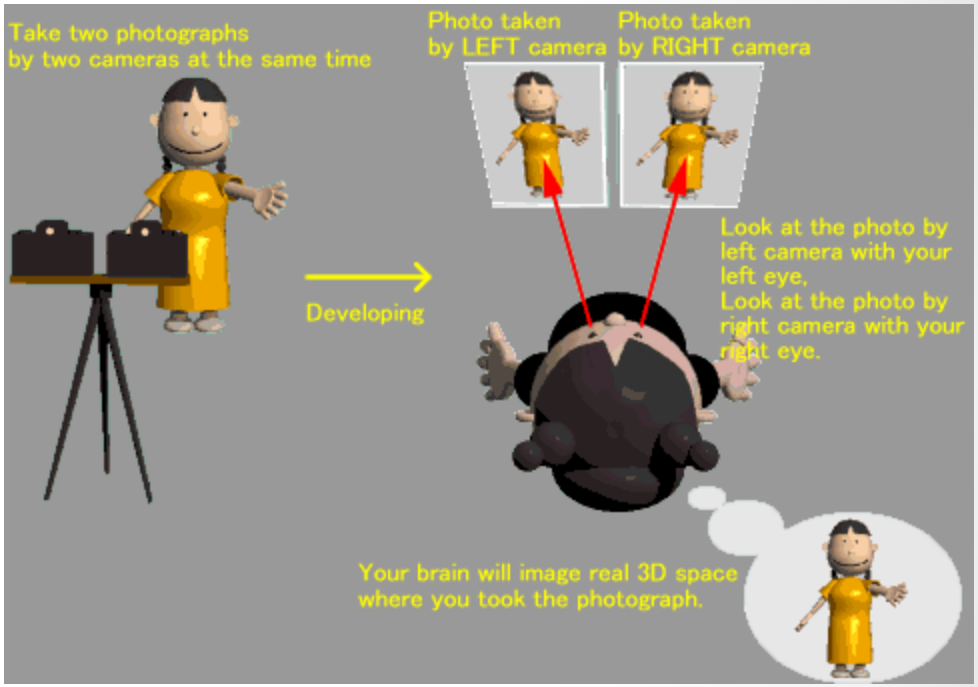
3D video principle

- Human eyes are two optical lens, two images are formed onto the human's retina through the left and right lens. Even the two images are originated from same object, but they are viewing from different angles, which results in slightly different between image. The human brain can judge the distance of the object through the information, this is reason we can see 3D object, on nature science call "binocular disparity".
- Current 3D-TV systems reproduce this binocular disparity at one fixed viewpoint. These are usually called stereoscopic television systems, or (more accurately) plano-stereoscopic television. There are a number of ways of carrying and reproducing the left and right eye signals for the viewer. Most current systems require the viewer to wear special glasses, although some do not (auto-stereoscopic systems).



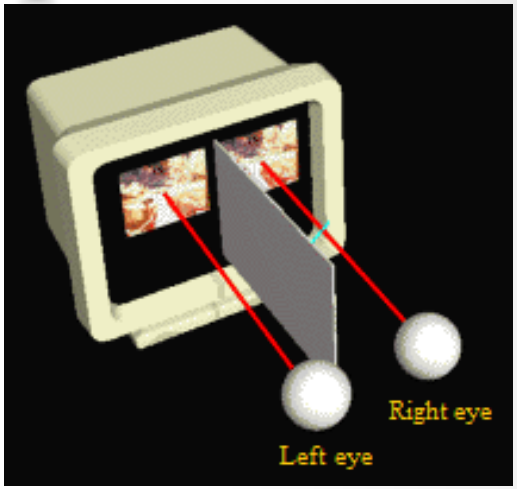
3D Video

- Why a human can recognize in 3D without the real object?
- Place two cameras separating about distance of your eyes.
- Capture Video by the two cameras at the same time.
- See the photo taken by left camera with your left eye, and see the photo taken by right camera with your right eye.
- Our brain calculate the difference of the images, and we will image real 3D space.



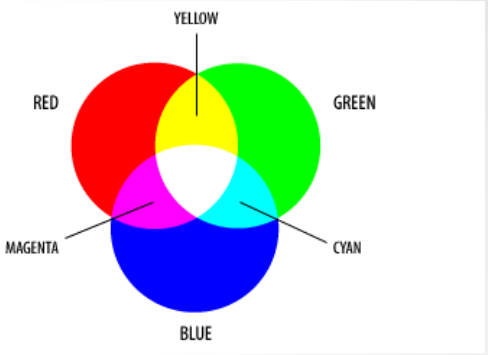
3D video principle

- How to make sure the left images go to your left eye and right images go to your right eye?
- In many of 3D cinema, the left image of movie and the right image of movie are projected to one screen by each movie projectors with polarizing filters.
- Use 3D glasses with polarizing filters to watch the movie.
- So the movie projected from left projector go into your left eye, and the movie projected from right projector go into your right eye.



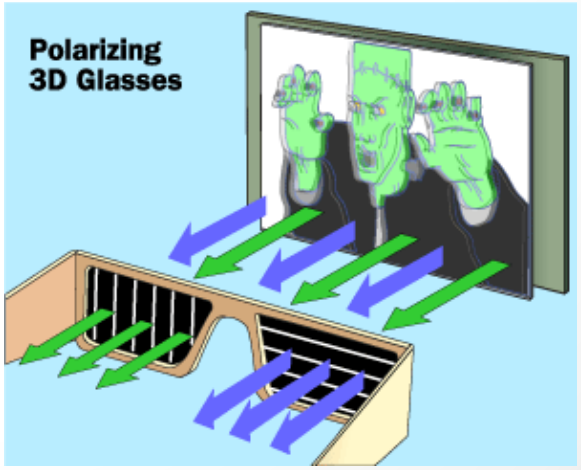
Stereoscopic TV using Colored glasses

- Viewing anaglyphs through appropriately colored glasses results in each eye seeing a slightly different picture.
- In a red-cyan anaglyph, for instance, the eye covered by the red filter sees the red parts of the image (with the brain providing some adaption for color); the eye covered by the cyan (blue/green) filter perceives the blue/green part of the image. => one view doesn't have red.
- The brain blends together the image it receives from each eye, and interprets the differences.
- Each eye therefore sees only the perspective it is supposed to see.



Stereoscopic TV using Polarized glasses

- Image quality is not good, if separate an image by color. Preferred method uses polarized lenses because they allow color viewing.
- Left and right images are projected superimposed onto the same screen through orthogonal polarizing filters (usually at 45 and 135 degrees).
- The viewer wears linearly polarized eyeglasses which also contain a pair of orthogonal polarizing filters oriented the same as the projector.
- As each filter only passes light which is similarly polarized and blocks the orthogonally polarized light, each eye only sees one of the projected images.

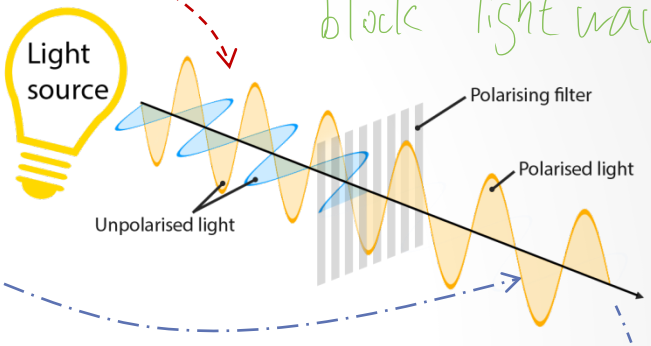


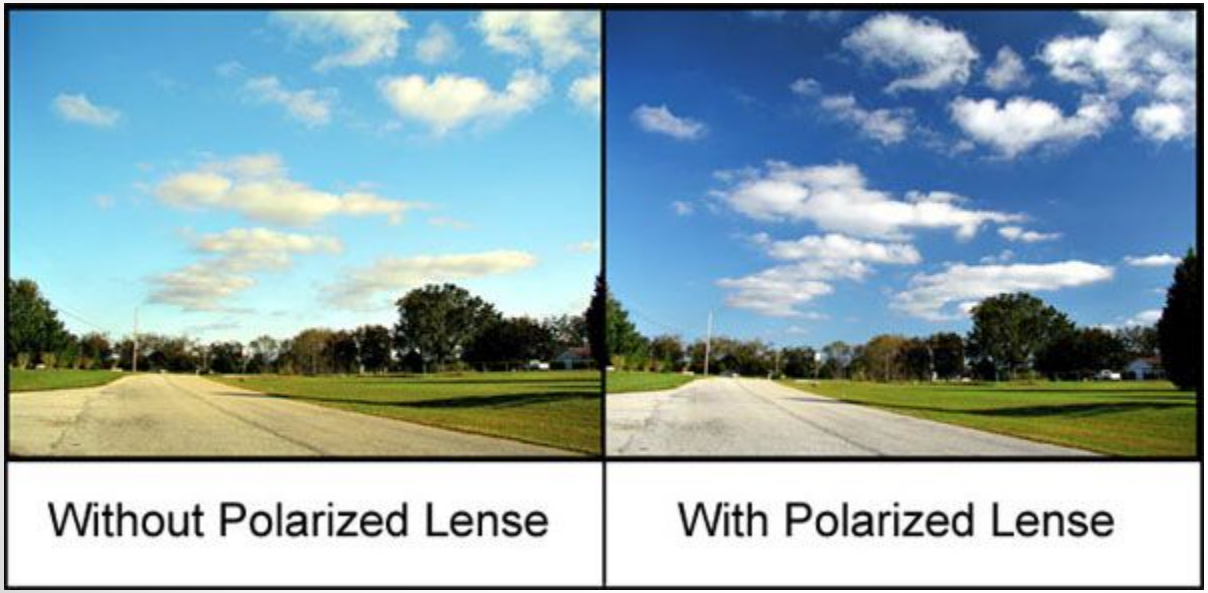
Stereoscopic TV using Polarized glasses

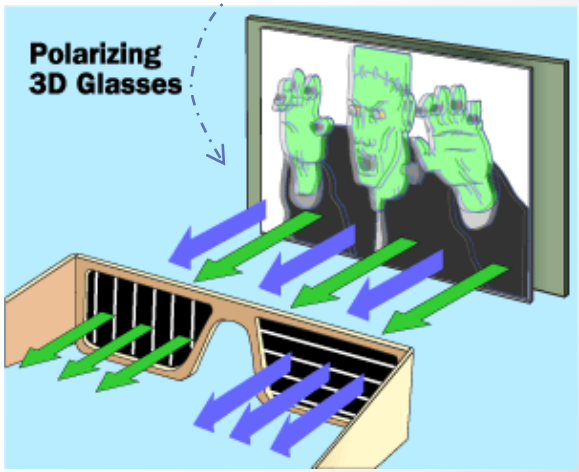
less brightness

- A linear polarizer converts an unpolarized beam into one with a single linear polarization. The vertical components of all waves are transmitted, while the horizontal components are blocked.

block light wave





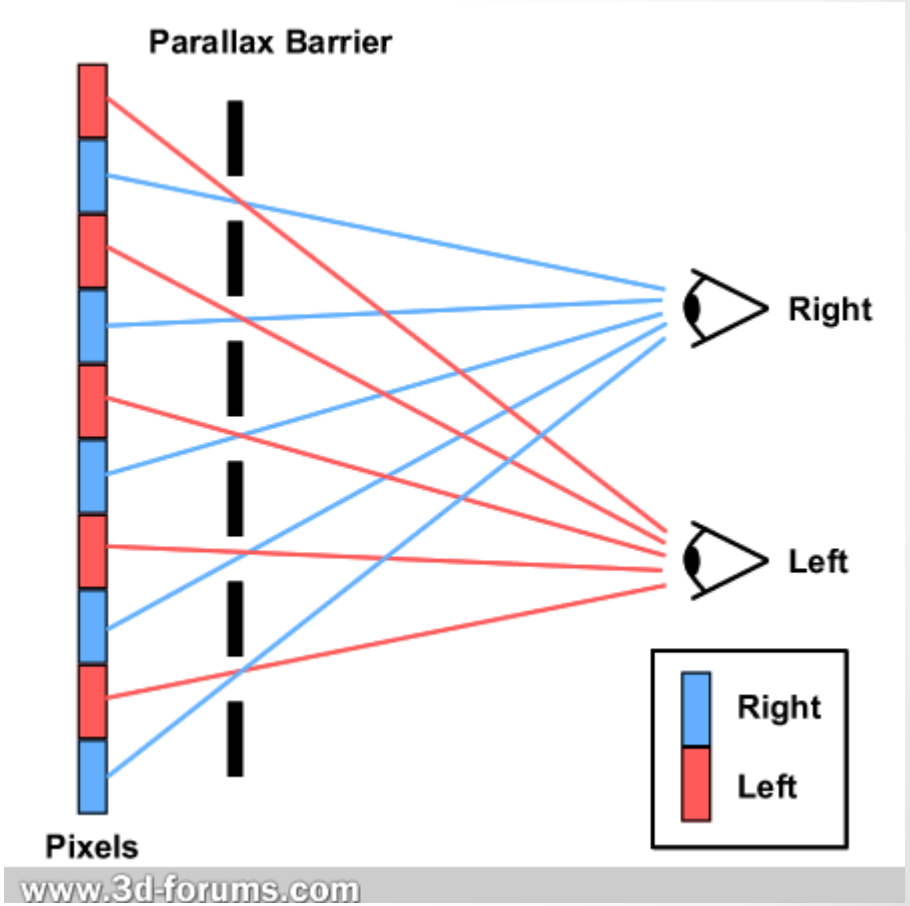


Stereoscopic TV using Shutter glasses

- Shutter glasses can be used to provide temporal filtering, which creates a stereoscopic effect by presenting different perspectives to each eye through alternate frame sequencing.
- The display alternates between left and right eye views whilst the glasses blank each eye alternately in synchronization with the screen.
- The shutter glasses are typically based on liquid crystal materials that have the property to become dark when voltage is applied, but are otherwise transparent.
- Unlike colored glasses or polarized glasses, these are active devices that require synchronization with the display through cable, wireless or infra-red communication.

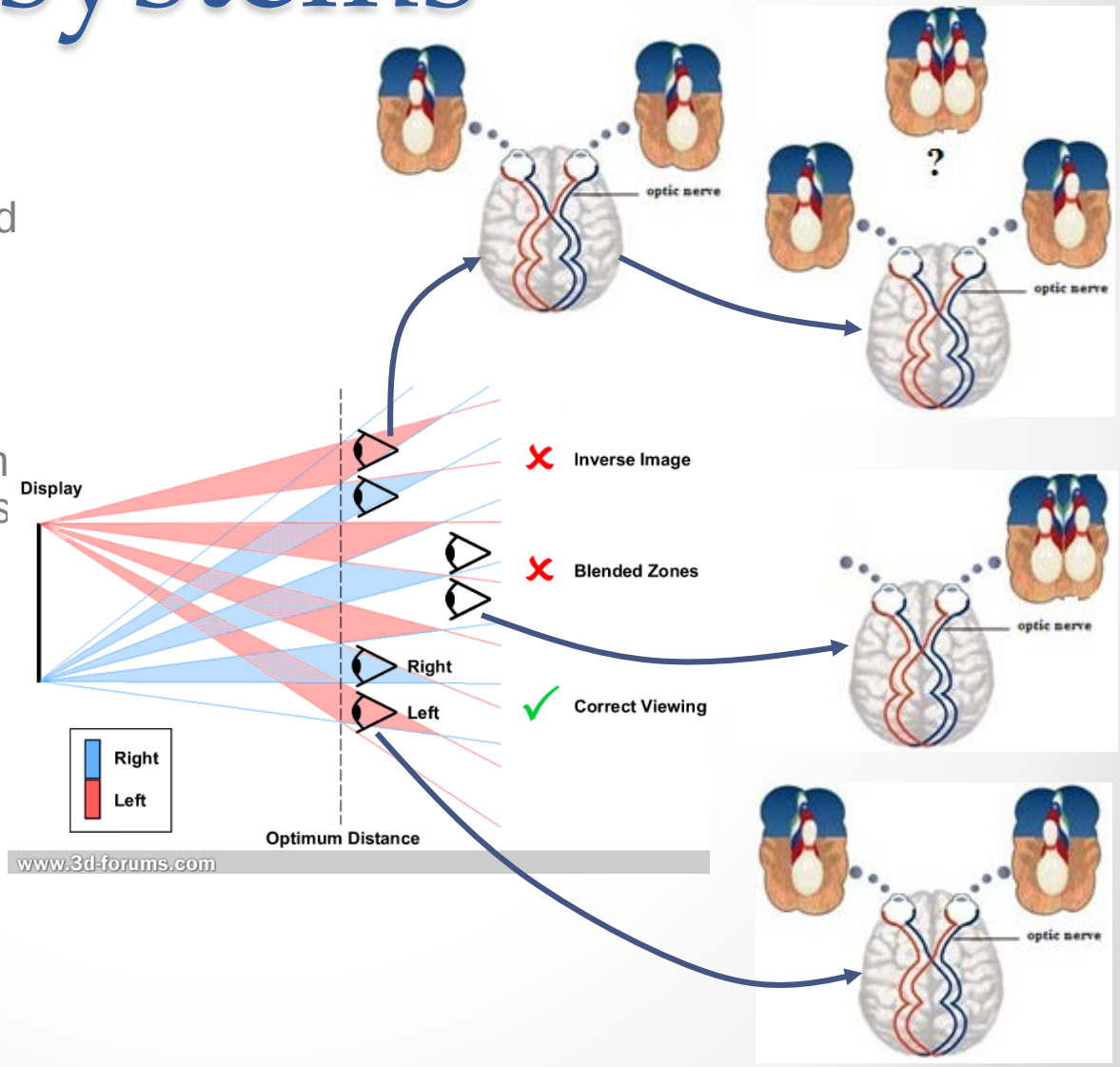
Auto-stereoscopic systems

- Auto-stereoscopic displays fool the brain so that a 2D medium can display a 3D image by providing a stereo parallax view for the user.
- This means that each eye sees a different image, having been calculated to appear from two eye positions.
- In the parallax barrier a mask is placed over the LCD display which directs light from alternate pixel columns to each eye.



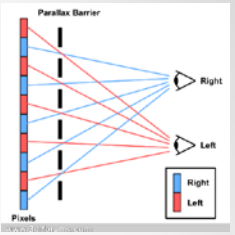
Auto-stereoscopic systems

- The viewer must be at the correct viewing position.
- The user to the right ("Inverse Image") is aligned incorrectly and the image formed at each eye is the wrong way round.
- The "blended zone" user is standing too far away from the optimal distance and is seeing both images forming in each eye, causing a blurred and confusing image.
- The user in the left is standing in the correct position, with each eye located within the correct viewing zone.

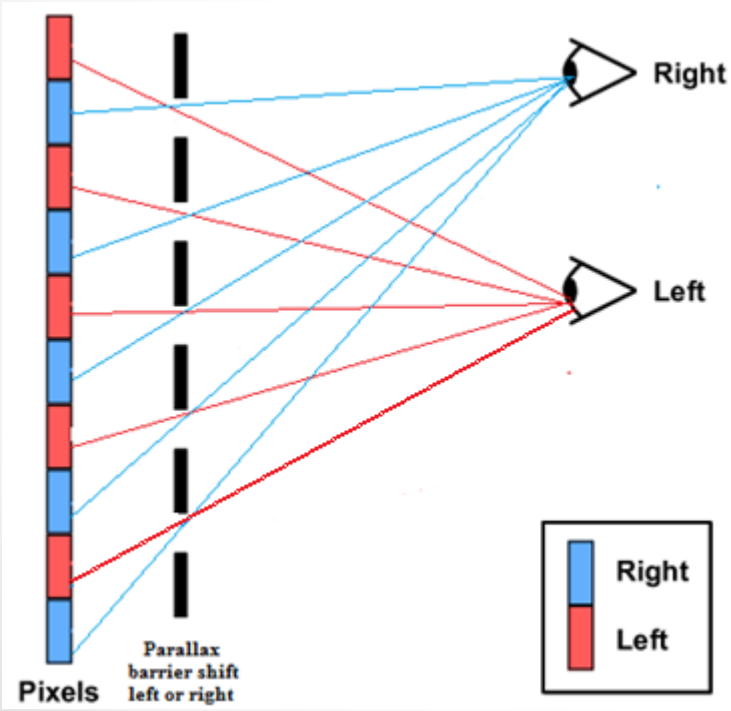


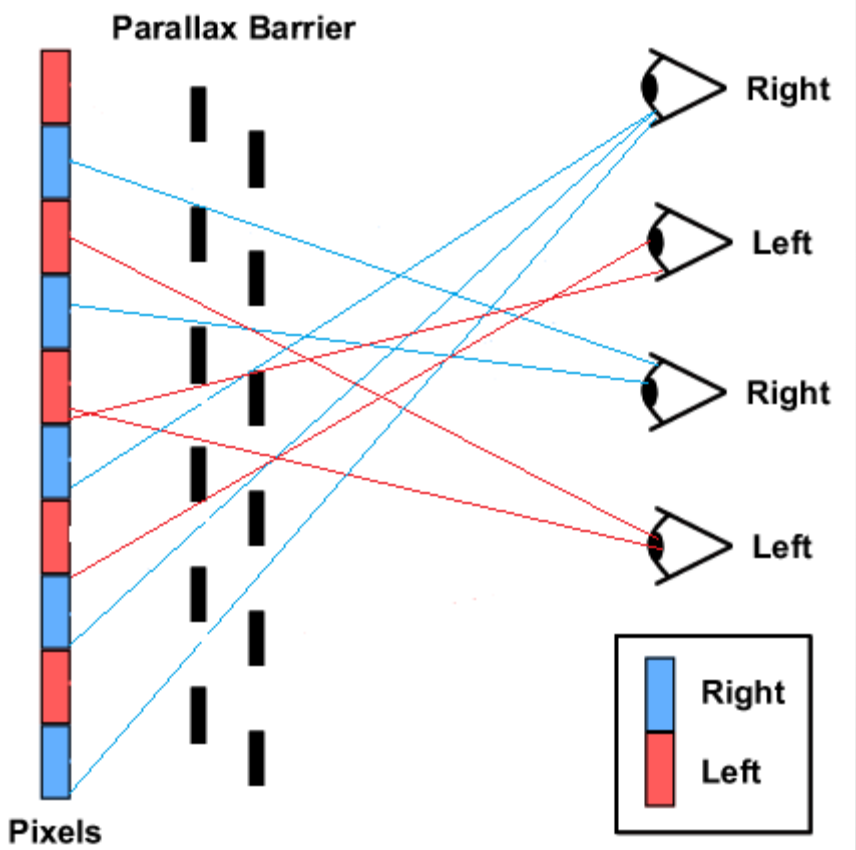
● 3D Video

Auto-stereoscopic systems



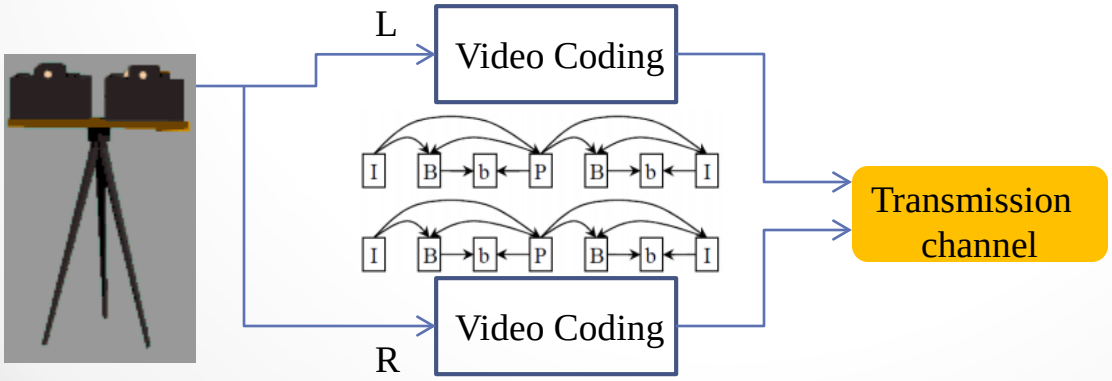
- Viewer position shift?
- Multi-viewers?





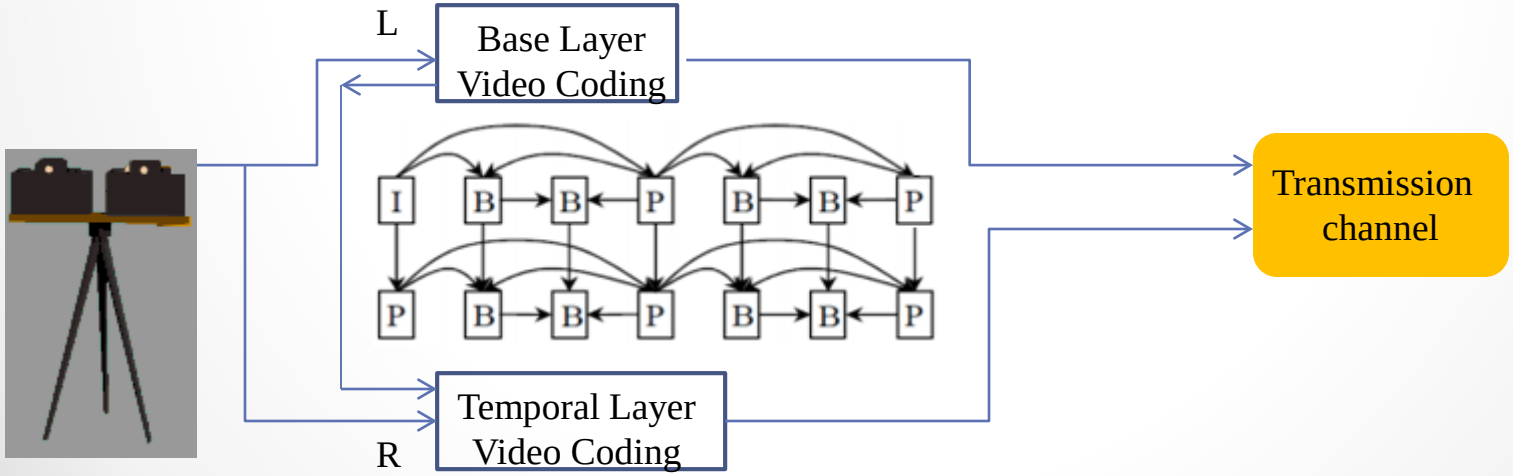
Simulcast coding

- To perform 3D video coding, a first straightforward solution consists of independently encoding the multiple views, called simulcast coding.
- In simulcast coding, both of the views are coded as two completely independent 2D videos (with no referencing between views). It is exactly the same as coding the two views of the 3D video in two separate steps with a conventional 2D video codec.
- However, simulcast coding does not exploit the correlation between the views. Because of its simplicity, simulcast coding is typically employed as a reference for comparisons of coding performance



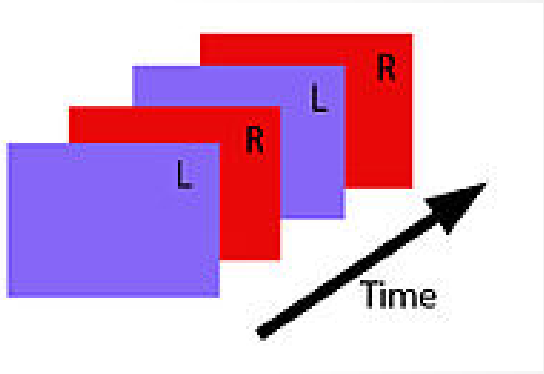
Interview prediction coding

- The left view was referred to as the "base view" and its encoding was compatible with that for generic video encoding. The right view was encoded as an enhancement view that used the pictures of the left view as reference pictures.
- A reference picture could either be a picture from within the enhancement view or a picture from the base view.



Frame sequential stereoscopic (3D) video

- Current stereoscopic systems use a frame-sequential 3D signal.
- Left and right frames are sent alternately to the display.
- This involves that the real frame frequency halves the video frame frequency.

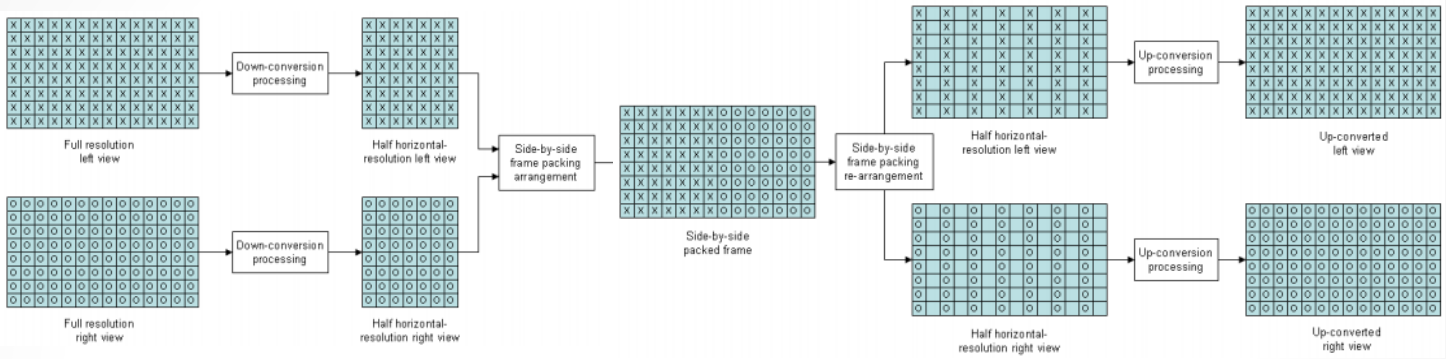


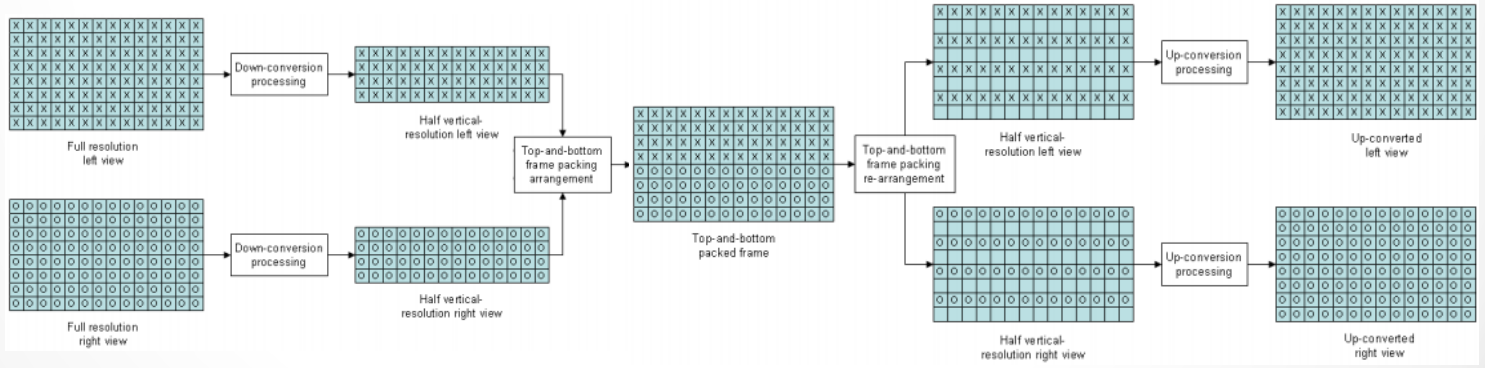
cut down frame rate

Frame compatible stereo (3D) coding

- A frame compatible plano-stereoscopic video format means that the left-eye and right-eye images are arranged in a spatial multiplex which results in a composite image that can be treated like a conventional HDTV image by the receiver demodulator and compression decoder.
- Left and right views are packed together in the samples of a single video frame.
- Facilitate the introduction of stereoscopic services through existing infrastructure and equipment, i.e. reuse the existing encoder and decoder.
- Only need to upgrade the software of set-top box and TV set.

Compatible video format



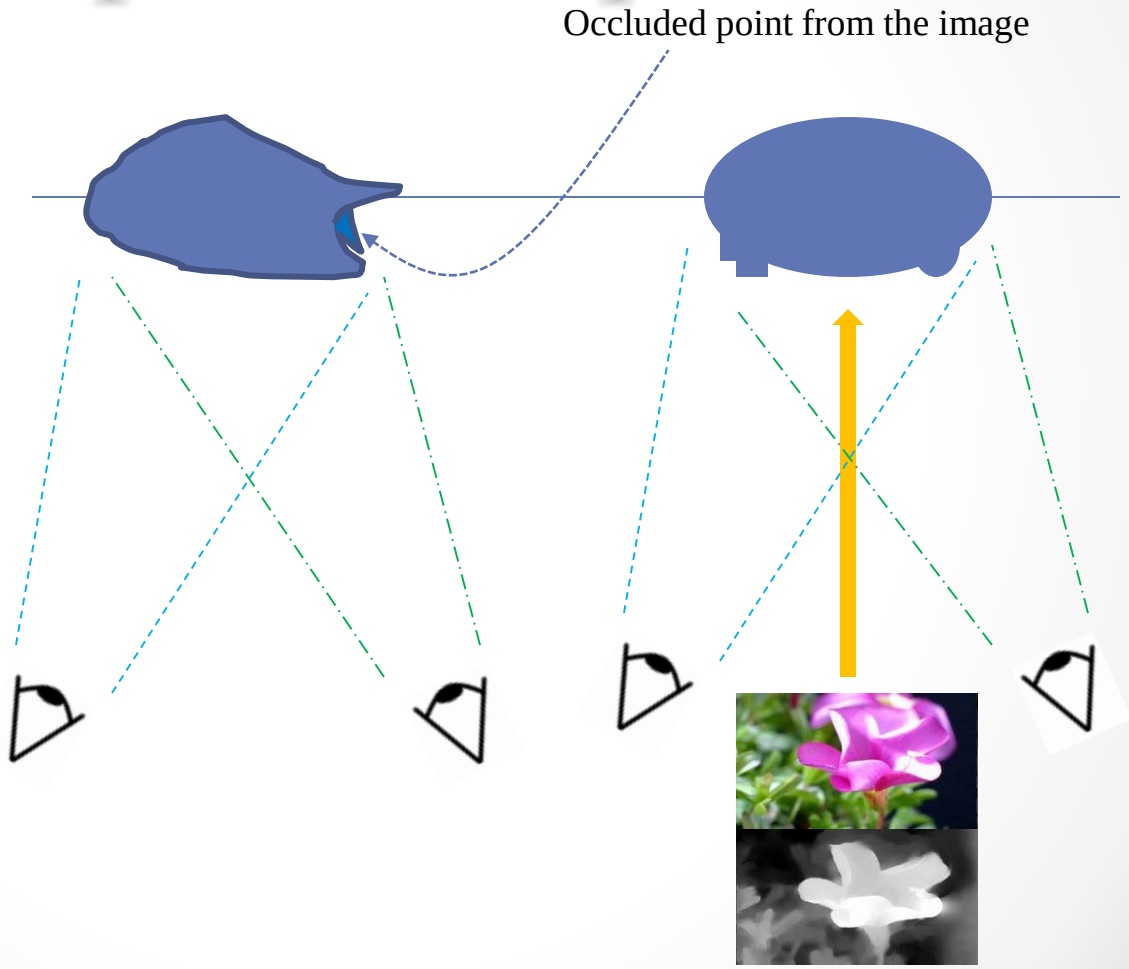


2D-plus-Depth

- The 2D-plus-Depth format comprises additional depth information (in grey scale) with every 2D image. The depth information indicates the position of each 2D image pixel on the Z (depth) axis in or out of the screen plane.
- In order to generate a 3D image, the display requires a regular 2D representation of the image and a depth-map. This depth-map indicates the distance between each pixel and the viewer. The 2D image and the depth-map are used to create images on the screen, and these images are then merged by the viewer's brain into a 3D sensation.
- Bandwidth increase compared to 2D (compressed greyscale increases bandwidth 5–20%)

2D-plus-Depth

- Cannot reconstruct 3D scene for the occluded area.
- The generated view will have holes or gaps corresponding to the part of the occluded point being exposed in the view position.




File Playing Help
File Playing Help
ballet_l.yuv - YUV Player Deluxe
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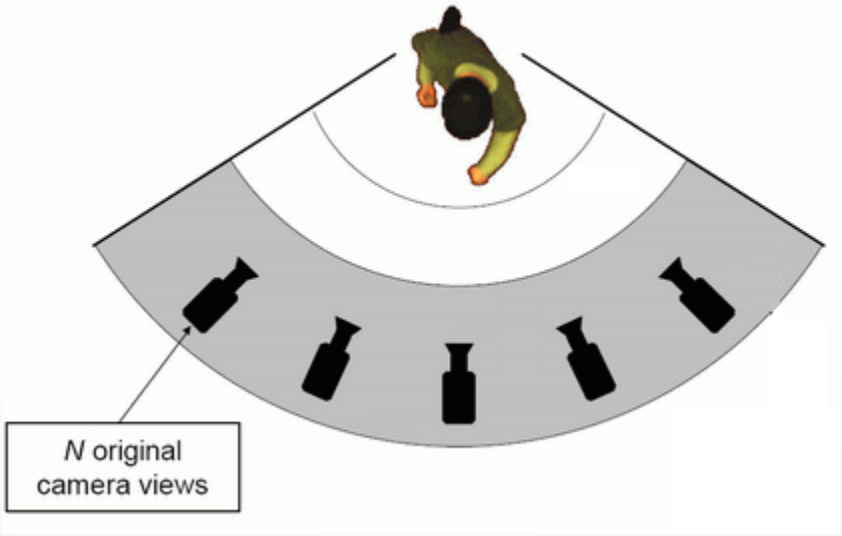
Multiview Video Coding

- Multiview Video Coding is an extension of the Advanced Video Coding (AVC) standard that provides efficient coding of such multiview video.
- The encoder receives *N* temporally synchronized video streams and generates one bitstream. The decoder receives the bitstream, decodes and outputs the *N* video signals.



Multiview Video Coding

- Multiview video contains a large amount of inter-view statistical dependencies, since all cameras capture the same scene from different viewpoints.
- Combined temporal and inter-view prediction is the key for efficient MVC.
- A picture of a certain camera can be predicted not only from temporally related pictures of the same camera, but also from pictures of neighboring cameras.